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INTERNATIONAL EDITION/166 TOTAL PAGES

DATAMATION

FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE

NOVEMBER 1, 1990

NETWORK ACTIVITY UPDATE-TUESDAY JAN 11

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Compaq, Senior Vice President,
Systems Engineering

SystemPRO Revs Up Networks

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NOVEMBER 1,
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DATAMATION

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VOLUME 36
NUMBER 21

Compaq's Stimac operates in minicomputer and mainframe territory.

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SystemPRO Revs Up Networks 30

BY BOB FRANCIS Compaq applies big-system hardware concepts to a local area network server that aces network-busting jobs. But full performance depends on other factors: software and systems implementation.

Cover photography by Janice Ruben

SPECIAL REPORT

SALARY SURVEY

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BY ANGELINE PANTAGES

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BY MIKE RICCIUTI

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IBM's Zeitler serves AS/400 power at lower prices.

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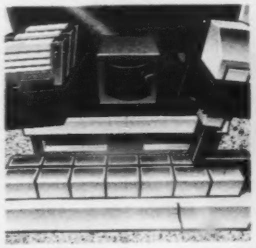

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Salaries Rise 5.6% In Soft Market

It could be hard times for many IS staffers, whose raises may not keep up with inflation this year. But for those with the right talents, the jobs are open and the money is still flowing.

BY ANGELINE PANTAGES

Salaries for chief information officers (CIOs) are in the six figures. Data and information network architects are being hired at $90,000-plus. Personal computer local area network experts, knowledge engineers and computer-aided software engineering (CASE) gurus are going at a premium. Triple threats with expertise in engineering, manufacturing and programming are in demand. There are job openings all around the country that are going begging.

Yet, the market for IS professionals nationwide has been dubbed soft by industry recruiters. Many companies that are downsizing aren't expanding their IS staffs. They're generally not giving big pay hikes to job-hoppers, and they're loath to pay the escalating costs of relocation. And, according to DATAMATION's new survey of salaries and trends among 166 responses, they may not be giving existing staff a big enough salary increase this year to cover the costs of inflation, which some economists expect to be 6%, or perhaps higher.

These are very mixed signals for IS professionals. But they have to listen carefully to what those signals are saying. There is some demand, but the job descriptions are highly specific and quite often require expertise in several technologies or in a combination of technology and business. Often, knowledge of an industry or of one or more business functions is required. Furthermore, companies are not too willing to settle for less. Either they won't fill them, or they'll contract the work out if they can.

Three factors are important in deciphering these mixed signals:

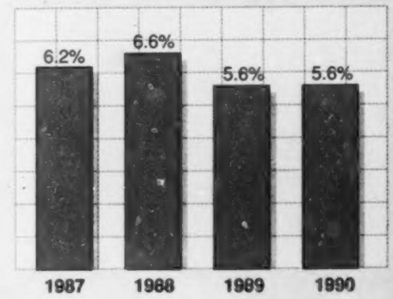
- The current employment down cycle in the market.
- The current skills needed—what's hot and what's not.
- The long-range technological and business needs of corporations racing to stay ahead of the pack or struggling to maintain competitive parity.

Steve Joffe, vice president of nationwide recruiter Source EDP, puts the current market softness into perspective. "What's going on now is a correction in the marketplace against the 'run run' of the '80s. It may last nine or 18 months, and then there will be another correction. I don't think there are many computer professionals who are unemployed, but they are doing jobs that are less mobile because of the softening in demand. Companies are not going for major expansions of computer staffs." For the first time in more than eight years, he says, this sluggishness extends broadly to *Fortune 500* companies and banking institutions.

DATAMATION's survey generally confirms his assertions. Overall, the responding firms said their "DP professional" work force will decline slightly in 1990 by 2.3%. The biggest cutbacks in this sample are among the troubled banks (a whopping 35%), DP services (13%) and industrial manufacturers (10%). Many small companies (with under $100 million in revenues) reported 15 to 25% cutbacks, while

Average Salary Increases Flat

Salary survey results show that pay hikes will equal last year's but are smaller than those handed out in 1988 and 1987.



Source: Datamation

It's time that information systems departments alter their salary structures.

the largest (with revenues over $3 billion) averaged a 2% decline. Regionally, respondents in the recession-plagued northeastern metropolitan areas—Boston, New York City and Philadelphia—plan to downsize by an average of 16 to 20%.

But the picture isn't all bleak. There are firms and regions that either are doing well or are beginning their ascent from the doldrums and have a pent-up demand for people. For instance, 7 to 9% staff increases on average are planned by respondents from the consumer manufacturing, distribution and transportation/utilities sectors. Government sites reported a 4% average hike. And outside the evidence of our sample, recruiters say that the health services sector is actively hiring.

Geographically, in the reviving Rust Belt, some Chicago and Detroit firms reported 20% increases, and there is healthy hiring going on in Houston, San Francisco and Washington, D.C. Source EDP's regional director for northern California, Dave Flansbaum, reports that San Francisco area companies that survived the "feeding frenzy of leveraged buyouts" four years ago, are now lean, profitable and looking for more IS people than the market can supply.

Is It Time To Change Jobs?

In such a volatile market, professionals have many concerns. What are their prospects in their current companies and locations? Will it pay to move, or should they sit tight? First, within their companies, according to the DATAMATION survey, the average increase in salaries is 5.6% in 1990, equal to last year's but less than the 6.6% increase of 1988 and the 6.2% rise of 1987. This generally holds true across industries and across the country, with the exception of banking and government sectors, which are giving less than 5%. Inflationary trends, fueled by the crisis in the Middle East, may result in the cost of living going up to 7% in 1990. The result: a net income loss.

So, when inflation and other economic factors are taken into account, the survey indicates that the average salaries of middle management and their staffs have not changed appreciably from last year. Flansbaum at Source EDP confirms this and adds a troubling note. "The salary levels for first-and second-line managers are pretty stagnant. But what's happening is that the technical people, who have been receiving increases, are compressing up against those management levels. Somewhere in the universe, it's etched in stone that managers must make more than people who report to them." The result is that some companies, because they can't make adjustments in salary administration, have been hiring consultants, paying them several times what an employee would cost. "This is false economy," Flansbaum says, adding that it's time that companies alter their salary structures.

The survey indicates a general cutback of 10% in part-time and contractual personnel, but Joffe insists: "You won't get that data from surveys, because a lot of these people are being brokered independently."

So, many in-house professionals are faced with a stagnant income and competition from well-paid consultants. It's also not clear whether they are always receiving the training to keep up with changing demands. Recruiters maintain that training programs generally have not been cut, but neither have they increased. Past DATAMATION surveys have indicated an average of about $3,000 spent on training per IS employee. That was true this year, but the average number of hours has declined somewhat from 65 hours in 1988 to 59 hours this year.

Where The Bucks Are

The East and West coasts are paying the best for the top IS slot, while the Midwest gets squeezed.

VP of IS, Average Salary

East Coast — $101,000
West Coast — $100,000
Midwest — $70,000

Hiring Practices

A buyer's job market has a variety of characteristics. Joffe and other Source EDP recruiters say that firms are typically paying less for the average new hire—a 10% raise compared with 20% in better times, lower bonuses and other incentives and less coverage, if any, of relocation costs.

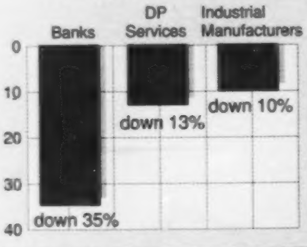
Another characteristic of the buyer's market is the demand for individuals with highly specific skill sets. Joffe says that firms typically want an individual to fill 80 to 90% of the job profile so that they can avoid the costs of training and realize optimum productivity almost instantly.

John J. Davis, principal of executive search firm John J. Davis & Associates Inc. in New York City, says the chief information officer or vice president of information systems is in demand because he or she is "someone with the big picture, experienced in strategic direction setting and in guiding the implementation of integrated systems to support revamped business processes." He finds there is no shortage of capable executives among the country's veterans who have spent their lives in information systems. And he believes many of them "can step into general management roles without difficulty." Six-figure salary packages are common for such talent, says Davis, noting that even in this market firms continue to offer a 25% premium to attract them as well as assurances of 15 to 20% in annual increases.

In this market, most companies, however, are looking for a "zero learning curve among their top and upper middle managers," says Davis, explaining that industry experience has become a requirement. "There is a desperate need for credibility in this highly competitive environ-

Who's Cutting Heads

Financial companies are planning the biggest staff cutbacks.



Who's Adding Bodies

High single-digit growth is occurring in four industry sectors.

Consumer Manufacturing — 7-9%
Distribution — 7-9%
Transportation/Utilities — 7-9%
Government — 4%

ment," he says, such as the IS executive for a retailer "who can talk to merchants as if he or she has known them for a lifetime."

Beyond the CIO, there are other upper echelon jobs going for $90,000 and over in larger firms. These, according to Davis, include:

- The database expert "not only skilled in logical and physical modeling" but also able "to reduce the technology to understandable business terms and to talk to the business issues which technology is supporting."
- The technology architect, the long-range planner for all information and communication technologies, "who can optimize the dollars spent on technology while optimizing the service delivered to end users."
- The expert in computer and communications security and risk management.
- The telecommunications manager knowledgeable about the complexities of planning voice and data networks and experienced in purchasing the right equipment and services in a deregulated environment.

> Somewhere it's etched in stone that managers must make more than people who report to them.

The Hybrid Professional

The need for people who combine technical and business knowledge has been cascading down into middle management and professional ranks. These include the systems analyst with expertise in marketing, manufacturing or other functions and the project leader adept at working with cross-functional teams.

Forrest Jerome, director of product development systems at New York City-based Colgate-Palmolive Co., feels "the days of the pure programmer or analyst are gone." For instance, he needs experts to develop integrated plant-floor systems—people who combine programming, engineering and process-control manufacturing knowledge.

Corporatewide, he says, "we need to support desktop devices—the PCs and Macs—in ways we didn't think about when they first started moving throughout the organization. We want people who not only can program on the Mac, using PASCAL or Fourth Dimension, but also have the experience in the type of PC-based LANs we're implementing and the ability to work with the users as a real member of the team. They have to understand what is going on in a business sense, participate in project teams with the user, and come back and translate their demands into code. That's a reach we haven't had before."

That's the point—as technology becomes more common in business, multitalented staffers are needed to make sure the technology has a true business impact. John Alexander, senior vice president and CIO at insurance firm UNUM Life Insurance Co. in Portland, Maine, points out that in-house training programs are filling the need for junior programmers and analysts. But he's been looking for people with such leading-edge skills as "knowledge-based systems, image processing and early stage cooperative distributed data experience in the PC LAN arena." His firm isn't just hiring heatseekers; it's building the capability to raise customer service and corporate performance to new levels.

He foresees a high demand for two new breeds of professional. One is "the workstation guru, who understands how to build applications that start with a graphical user interface and include a distributed data element." The application is partly done on the micro and partly in the mainframe or LAN server; or, in business terms, partly done in the branch, agent or broker office and partly done in the home office. With such an application, "one person fills out the insurance application, another does underwriting, and they are working from the same set of information," he says.

Another new breed is the person adept at integrating image processing, knowledge-based systems and conventional production data processing into either mainframe or micro-level applications. What this can mean in a business sense is illustrated by a multimedia, multifunctional application advertised by Wang Laboratories Inc. in Lowell, Mass., for property and casualty insurance. With this application, the various decision makers involved in a claim, wherever they are located, can display a photo of the damage, say to a car fender, call up the image of the customer's original claim forms and then, using a decision support process, rule on the claim and process it.

Companies are now committed to computer-aided software engineering and are looking for gurus who can both install the products and train application developers. In the mainframe arena, they want skills in current on-line and database systems, plus specific applications experience. In LANs, they need the expert who can select, install and support these networks, as well as LAN administrators. A new requirement is for microanalysts and programmers who can develop conventional business applications in a multimicro environment.

Some, like Joffe, believe that the rise of the technically savvy end user of the micro and the operational simplicity of powerful new systems such as IBM's AS/400 will slash the need for many IS professionals. But the increasing complexity involved in the integration of technologies and applications is creating new demand and new opportunity in this field.

So, Joffe believes, this is actually a good time for talented people to be looking for a job because many of the companies able to hire are those doing well. But, he advises, "Avoid the company looking to fill a need for the short term. Make sure the organization has a good long-range plan for information systems and network development and can offer a good career path." Again, the premiums for job-hopping "are not that great, so don't move for money alone unless you have a very hot skill, and you have not been paid exceptionally well where you are."

The ultimate word of advice for the IS professional is *optimize*. Optimize your income by optimizing skills that will optimize the business of the employer. ▭

Average Salary By Industry (In $)

	1990	CONSUM. MFG.	IND'L. MFG.	BANKING	FINANCE	EDP SERV.	DISTRIB.	GOV'T.
CORPORATE STAFF								
Vice President	85,089	110,000	72,500	76,000	45,000	97,000	90,000	62,489
Director of DP/MIS	65,816	72,066	63,286	91,667	50,500	83,667	43,000	52,285
Technical Services Manager	60,122	64,633	52,275	62,500	40,000	70,800	47,500	42,828
Information Center/Data Center Manager	50,778	67,670	44,200	N/A	30,000	56,400	47,500	46,234
Director of Security	48,320	45,000	39,000	65,000	N/A	47,500	N/A	37,932
SYSTEMS ANALYST								
Manager	52,178	55,750	51,083	66,000	34,750	57,667	47,000	43,802
Senior Systems Analyst	45,048	47,000	42,955	N/A	35,000	57,000	35,000	42,500
Lead Systems Analyst	43,052	41,260	45,000	48,000	N/A	41,500	N/A	42,000
Systems Analyst	39,411	34,500	44,000	N/A	25,000	44,500	44,000	35,000
Junior Systems Analyst	30,285	N/A	25,500	27,000	N/A	34,667	30,000	N/A
APPLICATIONS PROGRAMMING								
Manager	51,959	63,510	48,750	57,500	N/A	54,333	N/A	39,346
Lead Applications Programmer	37,320	30,333	37,200	N/A	N/A	50,500	N/A	31,932
Senior Applications Programmer	36,311	38,730	35,214	38,500	36,000	45,667	27,180	29,145
Applications Programmer	29,722	30,000	30,167	26,800	25,000	33,000	N/A	23,775
Intermediate Applications Programmer	28,403	23,000	32,250	28,500	N/A	28,500	13,971	22,667
Junior Applications Programmer	26,122	31,300	26,000	27,000	N/A	30,000	25,000	20,202
SYSTEMS ANALYST/PROGRAMMING								
Manager	52,543	46,000	54,386	N/A	N/A	53,250	56,500	46,331
Lead Systems Analyst/Programmer	44,686	41,945	51,207	N/A	N/A	53,333	42,333	37,955
Senior Systems Analyst/Programmer	38,862	35,690	43,321	52,000	31,800	46,000	39,667	35,385
Systems Analyst/Programmer	35,528	34,250	39,147	N/A	N/A	39,750	33,000	32,062
Intermediate Systems Analyst/Programmer	32,108	26,000	36,670	39,000	N/A	33,500	31,500	28,500
Junior Systems Analyst/Programmer	26,786	25,333	31,202	N/A	24,000	25,000	30,667	23,833
OPERATING SYSTEMS PROGRAMMING								
Manager	56,052	57,250	56,000	61,500	N/A	58,000	N/A	48,667
Senior Systems Programmer	44,318	42,200	43,932	70,000	N/A	32,334	36,500	43,162
Intermediate Systems Programmer	37,349	34,333	31,000	43,000	N/A	36,000	N/A	35,924
Junior Systems Programmer	32,427	23,212	25,000	35,000	N/A	46,000	N/A	32,136
DATABASE ADMINISTRATION								
Manager	53,426	40,000	53,547	50,000	N/A	63,667	N/A	41,551
Database Administrator	46,680	46,666	40,881	43,000	N/A	56,500	N/A	43,449
DATACOM/TELECOM/CONNECTIVITY								
Manager	52,228	42,000	46,750	75,000	42,000	55,000	N/A	42,699
Analyst	48,174	40,000	48,094	47,000	N/A	57,000	N/A	35,612
Network Engineer	44,626	N/A	37,000	42,000	N/A	43,000	N/A	38,506
Network Administrator	33,077	31,000	31,500	32,000	N/A	32,000	N/A	39,924
COMPUTER OPERATIONS								
Manager	43,356	36,000	43,500	39,333	N/A	47,667	44,800	42,793
Shift Supervisor	33,542	30,516	31,586	47,000	N/A	37,333	30,500	36,576
Lead Computer Operator	25,029	24,265	23,259	26,250	20,000	27,750	24,146	27,118
Computer Operator	21,090	19,772	18,500	28,000	N/A	24,033	19,380	23,080
Microcomputer/Workstation Manager	38,974	42,000	20,000	47,000	N/A	N/A	N/A	35,234
PRODUCTION & I/O CONTROL								
Supervisor	33,941	34,000	28,000	28,000	N/A	38,500	N/A	30,000
Lead Production Controller	28,681	31,058	24,000	22,000	N/A	30,000	N/A	24,850
Scheduler	26,711	26,638	22,875	19,000	N/A	24,000	32,000	22,000
Control Clerk	19,677	19,196	18,516	16,000	N/A	24,000	22,000	17,074
DATA ENTRY								
Data Entry Supervisor	23,341	23,500	23,667	34,000	18,000	24,667	27,000	22,000
Data Entry Operator	20,040	17,261	24,217	13,000	18,500	18,000	19,003	18,250
OFFICE AUTOMATION								
Word-Processing Supervisor	28,000	23,000	18,000	N/A	N/A	15,000	50,000	28,000
Word-Processing Operator	22,418	19,000	18,625	N/A	N/A	N/A	22,000	23,000
Microcomputer User Services Specialist	29,560	36,866	21,000	48,000	N/A	N/A	N/A	23,312
OTHER								
Specialist	24,794	N/A	25,000	18,000	N/A	30,000	20,000	20,000
Consultant	54,584	45,000	50,000	87,000	N/A	59,000	100,000	31,848
PC Evaluator	33,657	31,380	35,451	N/A	N/A	N/A	N/A	36,324
Business Analyst	45,333	N/A	40,000	86,000	N/A	N/A	N/A	N/A

			COMPANY SIZE							
MED./ LEGAL	TRANS./ ED/CONST.	OTHER	<$10M	$10M- $24.9M	$25M- $99.9M	$100M- $249.9M	$250M- $499.9M	$500M- $999.9M	$1- $2.9B	3B+
N/A	106,800	50,000	59,600	70,000	110,000	69,908	105,000	95,000	112,000	105,000
58,200	66,143	71,278	46,600	55,000	61,369	65,508	68,563	75,625	82,000	104,000
55,000	71,000	62,500	N/A	61,980	50,257	63,000	63,000	67,000	51,667	73,000
41,025	49,017	88,000	35,000	46,000	47,589	44,759	49,500	54,000	68,333	75,667
N/A	63,525	N/A	15,000	46,500	56,000	38,796	N/A	45,000	61,636	45,500
60,000	53,600	56,667	62,500	36,500	53,100	48,471	55,500	49,000	54,100	60,667
50,000	41,250	46,000	45,000	29,500	41,167	44,667	40,625	53,333	52,250	60,500
N/A	40,000	N/A	N/A	N/A	43,303	N/A	40,000	N/A	41,167	50,000
45,000	32,052	40,000	34,000	N/A	36,509	41,000	N/A	33,333	41,333	58,500
N/A	N/A	N/A	40,000	N/A	25,333	N/A	N/A	N/A	33,000	30,000
60,000	55,667	50,000	43,750	47,000	53,010	47,081	50,000	60,000	59,333	71,667
N/A	38,000	25,000	33,000	26,500	39,500	26,283	40,333	N/A	50,000	58,000
50,000	55,000	36,667	28,500	N/A	34,397	34,802	37,667	35,000	43,136	50,000
32,012	38,500	33,000	24,250	26,500	30,500	29,340	27,208	35,000	40,333	40,000
32,000	45,000	N/A	19,667	N/A	22,990	32,000	29,040	N/A	36,667	40,000
N/A	28,000	22,500	14,000	N/A	25,400	25,000	21,500	32,000	31,000	36,500
70,000	53,795	51,971	52,500	49,200	42,000	50,331	52,214	54,533	57,250	51,000
38,200	45,040	47,750	50,000	43,000	44,890	31,848	44,594	53,400	44,333	44,000
30,000	30,092	40,750	50,000	38,333	38,746	38,800	37,061	41,761	41,250	35,500
28,000	36,967	36,775	45,000	30,000	34,375	33,500	33,967	37,776	36,400	42,275
N/A	29,000	28,200	35,000	27,000	33,333	35,000	27,900	34,674	33,000	50,000
18,000	25,000	N/A	21,000	N/A	26,400	N/A	24,000	34,004	31,750	28,500
N/A	49,000	62,500	47,500	50,000	65,500	55,000	47,000	59,250	54,500	63,500
54,000	54,700	55,000	55,000	20,000	45,667	38,162	43,100	51,398	46,500	40,000
N/A	55,000	40,000	N/A	N/A	43,000	29,949	30,000	42,500	43,667	32,000
26,500	40,000	30,000	63,000	33,213	33,333	20,000	23,000	23,000	35,000	27,000
N/A	75,000	65,000	63,000	28,500	64,000	38,162	N/A	63,094	62,667	65,000
50,000	60,000	45,140	70,000	N/A	45,500	37,962	35,567	48,257	49,000	52,500
55,000	62,500	60,000	25,000	48,500	59,333	50,159	47,000	53,500	66,000	61,000
45,000	60,000	53,400	18,000	N/A	43,500	41,279	48,600	58,094	54,000	53,500
N/A	60,000	55,000	N/A	50,000	42,000	27,012	N/A	N/A	48,667	37,000
N/A	45,000	25,000	N/A	N/A	29,000	29,462	38,000	N/A	41,667	25,000
38,460	59,667	43,150	35,143	42,333	38,600	40,981	39,097	49,333	53,229	57,333
26,000	39,400	27,500	25,000	17,000	34,280	29,924	31,050	34,000	40,625	39,000
20,364	29,667	29,950	19,900	21,933	24,841	26,169	22,115	22,667	32,500	28,000
22,000	25,552	16,250	14,750	18,000	20,266	20,567	21,043	20,000	25,143	29,333
55,000	N/A	36,250	40,000	N/A	47,000	36,324	32,500	42,000	N/A	20,000
N/A	50,000	39,500	36,000	32,500	27,667	33,000	35,000	42,000	38,667	20,000
N/A	45,000	N/A	N/A	30,000	23,558	23,700	30,000	37,000	33,667	18,000
N/A	40,000	35,000	N/A	N/A	19,458	N/A	25,312	31,667	29,500	18,000
N/A	23,000	20,000	N/A	16,068	17,639	18,574	19,016	21,500	23,250	15,000
16,644	N/A	19,750	23,000	24,167	27,000	22,000	22,322	27,000	23,000	18,000
14,250	21,500	18,000	25,625	19,017	18,335	19,333	17,907	21,000	17,875	15,000
N/A	37,500	15,000	15,000	N/A	23,000	N/A	37,500	N/A	39,000	18,000
N/A	24,107	32,500	19,500	28,000	20,303	26,000	N/A	N/A	22,500	16,000
18,000	60,000	N/A	19,000	N/A	34,850	29,000	18,000	N/A	36,500	14,000
N/A	[illegible]	10,400	23,467	20,000	N/A	N/A	23,772	N/A	27,667	27,000
N/A	N/A	20,000	100,000	35,000	53,500	31,848	N/A	N/A	32,000	65,000
20,000	55,000	40,000	20,100	N/A	43,190	36,324	25,676	N/A	55,000	N/A
N/A	N/A	30,000	N/A	N/A	66,000	30,000	N/A	N/A	N/A	40,000

Source: DATAMATION

Average Salary By Region (In $)

	1990	EAST COAST	SOUTH-EAST	MID-WEST	SOUTH-WEST	WEST COAST	OTHER
CORPORATE STAFF							
Vice President	85,089	101,000	87,500	70,000	77,859	100,000	N/A
Director of DP/MIS	65,816	77,944	54,347	66,200	54,162	78,566	40,500
Technical Services Manager	60,122	62,122	61,400	70,000	50,664	57,829	60,000
Information Center/Data Center Manager	50,778	51,364	42,600	61,167	50,871	56,204	30,500
Director of Security	48,320	50,750	32,500	47,000	43,265	67,525	N/A
SYSTEMS ANALYST							
Manager	52,178	53,250	60,500	56,625	44,051	57,300	N/A
Senior Systems Analyst	45,048	47,591	49,333	37,500	38,833	55,000	33,500
Lead Systems Analyst	43,052	43,000	45,000	38,256	45,000	44,010	N/A
Systems Analyst	39,411	39,857	46,000	34,600	41,013	43,000	30,000
Junior Systems Analyst	30,285	27,500	38,000	N/A	25,500	30,000	N/A
APPLICATIONS PROGRAMMING							
Manager	51,959	54,446	41,833	56,250	51,122	61,510	39,000
Lead Applications Programmer	37,320	30,667	39,250	28,667	38,145	44,600	35,000
Senior Applications Programmer	36,311	40,000	31,420	32,670	35,547	45,653	22,500
Applications Programmer	29,722	28,000	26,933	25,250	28,719	41,200	26,000
Intermediate Applications Programmer	28,403	31,333	20,994	25,540	33,000	36,667	N/A
Junior Applications Programmer	26,122	27,857	20,750	N/A	26,202	28,400	N/A
SYSTEMS ANALYST/PROGRAMMING							
Manager	52,543	53,500	62,167	52,509	45,018	51,036	42,000
Lead Systems Analyst/Programmer	44,686	52,250	48,276	42,720	37,555	45,680	34,000
Senior Systems Analyst/Programmer	38,862	48,500	40,333	37,313	37,385	40,521	31,000
Systems Analyst/Programmer	35,528	37,750	36,009	35,017	36,338	36,360	30,000
Intermediate Systems Analyst/Programmer	32,108	37,000	29,250	31,058	34,533	34,000	N/A
Junior Systems Analyst/Programmer	26,766	29,000	23,400	28,602	30,833	26,000	22,000
OPERATING SYSTEMS PROGRAMMING							
Manager	56,052	66,143	41,500	41,000	51,500	63,333	N/A
Senior Systems Programmer	44,318	45,250	39,000	41,518	45,331	47,600	N/A
Intermediate Systems Programmer	37,349	38,600	36,000	23,000	31,924	47,500	N/A
Junior Systems Programmer	32,427	31,600	25,713	31,500	37,852	31,667	N/A
DATABASE ADMINISTRATION							
Manager	53,426	65,000	48,000	42,063	42,841	70,000	78,000
Database Administrator	46,680	48,000	36,000	45,642	44,341	49,167	N/A
DATACOM/TELECOM/CONNECTIVITY							
Manager	52,228	63,625	36,667	44,000	41,449	60,000	28,000
Analyst	48,174	52,800	30,000	61,188	37,479	56,250	N/A
Network Engineer	44,626	46,000	36,000	N/A	32,006	55,000	N/A
Network Administrator	33,077	35,000	32,000	36,000	28,424	33,500	N/A
COMPUTER OPERATIONS							
Manager	43,356	46,258	43,875	40,229	40,914	53,600	N/A
Shift Supervisor	33,542	34,178	33,000	28,000	34,745	33,130	32,000
Lead Computer Operator	25,029	25,957	23,081	23,089	23,771	31,268	21,500
Computer Operator	21,090	23,109	18,171	19,734	22,000	24,095	18,000
Microcomputer/Workstation Manager	38,974	48,000	N/A	40,000	28,162	32,500	N/A
PRODUCTION & I/O CONTROL							
Supervisor	33,941	34,250	34,000	27,500	32,500	40,000	35,000
Lead Production Controller	28,681	29,667	30,000	N/A	20,850	32,039	30,000
Scheduler	26,711	27,400	25,812	32,000	18,000	27,305	N/A
Control Clerk	19,677	19,200	20,700	22,000	16,049	22,305	N/A
DATA ENTRY							
Data Entry Supervisor	23,341	26,400	25,667	19,167	26,500	23,000	N/A
Data Entry Operator	20,040	19,500	17,526	17,794	20,750	30,400	20,000
OFFICE AUTOMATION							
Word-Processing Supervisor	28,000	19,000	45,000	50,000	24,000	28,000	N/A
Word-Processing Operator	22,418	N/A	14,750	20,333	22,702	29,333	N/A
Microcomputer User Services Specialist	29,560	35,500	17,000	25,750	23,750	48,700	22,000
OTHER							
Specialist	24,794	19,000	45,000	19,000	23,500	34,772	N/A
Consultant	54,584	74,000	40,667	20,000	60,616	N/A	N/A
PC Evaluator	33,657	38,500	14,776	40,000	36,324	43,190	N/A
Business Analyst	45,333	66,000	N/A	N/A	40,000	30,000	N/A

Source: DATAMATION

A United Approach To PC Purchasing

Although PCs have been taken seriously in the office for years, IS departments and end users are still at odds over how to handle PC purchasing. But by setting philosophical differences aside, a few firms are finding a successful middle ground.

BY DENNIS HAMILTON

In the late 1970s, the Bank of Boston gained some notoriety when, in embracing personal computing, it allowed users free rein to buy whatever they thought they needed. In the end, almost everything had to be scrapped as incompatible and impossible to maintain.

In the ensuing years, companies and their IS departments have tried various combinations of user freedom and central IS control in search of a lucid PC acquisition process. But even after purchasing some 45 million PCs, companies are finding that their acquisition remains a center of chaos.

Even though the free-rein theory has been discredited for more than a decade, many user departments are following it anyway and finding scant resources to help them make decisions. For a while in the mid-1980s, IS attempted to take control of the PC acquisition process. But a lingering disdain for the machines, along with nagging questions about who should pay for them, support them and program them, left users feeling jilted. Compounding the difficulties was the view from the opposite extreme, usually held by operating departments, that PCs were the solution to everything.

"What I notice with my clients, even those with big MIS departments, is that they seem to be getting more and more independent of MIS in their purchasing decisions," observes Michael Piaser, vice president of information-processing center services for Management Reports Inc. (MRI), a Beachwood, Ohio, data-processing services bureau that helps clients acquire PCs. "And they're screwing it up right and left."

"PC prejudice or mainframe prejudice are hard things to overcome," says Neil Hennessy, director of corporate communications and office systems for Reader's Digest Association in Pleasantville, N.Y. "You have this real battle going on with what I call classical DP and the little guys." To escape the battle, users have tried other outside sources, only to find their recommendations not always in agreement with their companies' overall IS strategy. Says consultant Piaser: "These poor users are trusting hardware companies, and the hardware companies are wrong most of the time."

In the final analysis, the IS department—which should be wired more precisely into corporate computing needs and business requirements than anyone from the outside—is most often the best choice to lead the PC acquisition process. But, in many cases, IS is defaulting. "There's a schism in data processing, and it's brought about mainly because mainframers can't think PC. The foot drag-

STATE OF GEORGIA'S CAWLEY: Traditional IS managers need to get away from floating point decimal problems and spend more time addressing PCs, people and the bottom line.

ging is in the mainframe arena," says Edward Cawley, data center manager in Savannah for the State of Georgia.

The LAN Factor

The explosion of local area networks in the past two years could be the catalyst that finally spurs coherent IS involvement in PC acquisitions. At the heart of the LAN movement is the fact that PCs aren't just for individuals anymore. "You only get corporate productivity when you have the PCs work together," maintains Dan Ness Jr., an industry analyst for Computer Intelligence, a La Jolla, Calif., market research firm.

Too often today, however, IS departments still hold out all but token cooperation when it comes to integrating PCs into companywide networks. "I'm trying to think of one instance where the MIS department was involved in the LAN acquisition [for a client], and I'm coming up short," confesses Piaser of MRI.

☐ **PC Acquisition Remains A Center Of Chaos For Many Companies.**

Some believe the resistance comes from business culture and computer politics. "A lot of mainframe people can get inside logic modules and floating point decimals, but they can't address themselves to the bottom line," says the State of Georgia's Cawley.

Making matters worse is a problem with the IS work load. Piaser reasons that if IS appears to lack initiative in leading the PC acquisition process, it's because many don't have the hours in a day to figure it out. "You talk to them, and they're so stuck doing maintenance and mainframe requests and mini requests that they don't have time. This [work load] hasn't decreased one iota just because PCs are out. It might even be worse."

The Problem At The Top

Although IS departments shoulder much of the blame for not pursuing coherent PC acquisition strategies, they are not the only ones at fault. Many believe that top management has ignored the problem.

Notes Piaser of MRI, many top managers were too easily swayed by the ease-of-use hype concerning PCs and PC LANs from a number of computer and networking manufacturers. Many of those assumptions turned out to be wrong, based on the popular myth that PCs—and by extension LANs—are so simple that they virtually run themselves. Consequently, many top managers today underestimate the need to formally educate highly skilled computer technicians about these simple machines.

Meanwhile, end users have hurt their case by purchasing PCs on their own with petty cash, sometimes hiding the acquisition altogether by listing it on the budget as a filing cabinet. Pressed between top management's nonchalance and user departments' troublesome initiative, IS reluctance to forcefully sort out the process becomes more understandable.

Signs Of Détente

There are signs, however, that some IS shops are attempting to formally acknowledge the role PCs are playing in corporate computing. The key appears to be a strategic corporate commitment, from top management on down, that system acquisitions should not be done by size of computer but rather with the best solution in mind.

The transition from PCs to LANs is what's behind this change in attitude. "They [LANs] give users that much more in resources. But they also give the IS department its control back to a certain extent," maintains Mark Stokes, information systems resource manager for the Computer Resources Group Inc. (CRG), a San Francisco-based consulting firm. What IS has to concede, is that this new form of control is not absolute. "We've grown out of that chaos and learned some serious lessons. One of them is that you can't control everything in the PC world.

"It really depends on the corporation's attitude," Stokes adds. Although there's still a lot of "diversity"—a code word for a motley assortment of varyingly successful PC acquisition programs—he sees a positive trend emerging. This is where the more successful companies form teams composed of IS members and end users. These teams then set PC acquisition policy and carry out large PC purchases together.

A Horizon Of Hope

Analyst Ness of Computer Intelligence also sees considerable crossover between once-separate IS and PC departments. Computer Intelligence conducts a monthly survey of 1,500 mainframe sites with 500 or more employees. One area

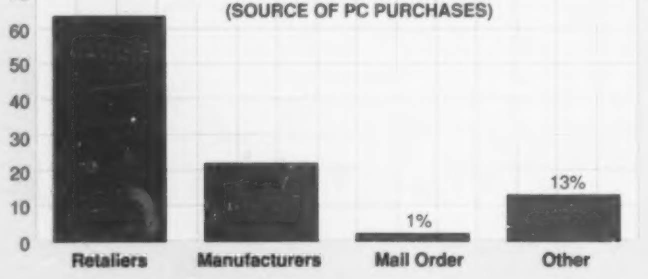
PC Purchasing: A Matter Of Policy

Relatively few large companies have perfected their PC buying techniques. But among those that do have effective policies, the following eight traits are usually shared.

1) No absolute center of computing power is apparent.
2) IS and operating departments work together.
3) No one buys equipment outside of the agreed-upon standards and guidelines.
4) IS makes an open commitment to PCs where they are the best solution.
5) Money for equipment comes from user departments.
6) IS accepts PCs into the formal IS umbrella.
7) IS appoints full-time PC coordinators.
8) IS agrees to learn—and talk—business.

PC Purchasing Channels For Large Companies

As computer retailers increase their level of PC service, big companies are rewarding them with the bulk of sales.



Source: Computer Intelligence Corp.

How Reader's Digest Purchases PCs

The Reader's Digest Association has gotten big by thinking small. Thanks, in part, to its successful PC acquisitions program, the association's diminutive magazine continues to be one of the most widely read publications in the world.

Neil Hennessy, the director of corporate communications and office systems for Reader's Digest Association in Pleasantville, N.Y., is in charge of PCs for the company. He also is a full-time member of the company's IS management team, is a director in the data-processing department and sits on the committee that buys mainframe equipment. In other words, he is the exception to the rule that says PCs and PC managers are renegades.

PCs have assumed a measurable percentage of the processing work load at the Reader's Digest. "If you could represent it in horsepower," says Hennessy, "our big computer [an IBM 3090] downstairs has 85 horsepower. There's 2,100 horsepower sitting on the PC networks." Approximately 300 more PCs are added to the stew each year, and Hennessy is charged with making sure everything works correctly, including user requirements, budgets, hardware, software and micro-to-mainframe connectivity.

According to Hennessy, a simple organizational change in the IS department is largely responsible for making PCs a consideration in every systems discussion. Where the department was once organized vertically, by technology—voice communications, data communications, PCs, applications, etc.—things now have been reordered horizontally by function. For example, a field-engineering group installs PCs, telephones and terminals, and a networking group handles all voice and data communications.

Hennessy's acquisition procedures involve a mixture of fixed and flexible elements. He sends out requests for PC acquisition forecasts at the beginning of the year to all user department heads, including the IS department. The departments then return a schedule telling him what types of PCs they want. Decisions are made with the technical advice of an analyst from the office systems group working closely with the department heads.

The teamwork-oriented acquisitions process is one that Hennessy believes would work well at practically any large company. "Those who don't take a hold of it now are going to have a heck of a time trying to put it together in two years," he says.

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it studies is PC-purchasing trends, and here Ness concludes changes are happening. "In the last couple of years," he says, "people have emerged whose titles are PC coordinator and end-user computing coordinator. They are leading the process." And, he says, many are full-fledged members of the IS team.

Driven by the IS issues of connectivity and standardization, the acquisition of PCs is quietly becoming formal and successful in some organizations. One way that many large companies are standardizing their purchases is by relying more on the expertise of certain retail computer stores. "Two-thirds of the computers are being purchased through retailers and dealers such as Businessland and ComputerLand," says Ness. Only about one in five of the PCs are coming directly from manufacturers. And only 1% of the PC acquisitions are via mail order.

One reason for the retailers' success is that computer stores are investing in production facilities that can deliver tailored machines en masse. MicroAge Computer Inc., for example, maintains a 275,000-square-foot National Accounts Distribution Center in Tempe, Ariz., which caters to the specific needs of corporate accounts. The facility can configure up to 1,000 computers per day for shipment, including interface boards, LAN cards and software.

Retailers are also making it easier for large companies to finance their PC purchases. "We're finding a lot of the large corporations going the lease route because they don't have to carry the PCs on their books," says Michael D. Reese, sales manager for a MicroAge store in Indianapolis. "It's a write-off to the bottom line."

Reese adds that leasing companies have become more creative in their leases, pulling together master-lease packages that allow companies to add computers when they need them. "They will even allow trade-ins if they meet certain requirements for resellability," he says. "All of this allows companies to move up to the next level in the PC market when they're ready to, at virtually no extra cost to them."

A Large Role For IS

If the events of recent history are any lesson, IS departments—not users or top management—must take the initiative in establishing clean PC acquisition processes. PCs aren't typewriters, and LANs aren't telephone extensions. The inexorable demand for enterprise computing environments has conspired to drop PCs right back in the lap of IS. The question now is whether IS embraces the possibilities or brushes them off. A lot hinges on the answer, but many managers will need philosophical breakthroughs even to admit a PC coordinator onto the IS team.

"What the user department wants to hear is that it really won't be his problem," says Piaser of MRI. "If MIS comes in and takes the problem away, the user is going to be a lot happier." ▭

"They are the ghosts of people you've fired."

Dennis Hamilton is the founder and principal of Software Analytics, an Indianapolis-based computer technology research firm.

How To Recruit Trading Partners

Recruiting trading partners is often the most costly element when a company begins instituting electronic data interchange. Here are five ways to set up a successful program.

BY SHARON CLARK

All dressed up and nowhere to go.

Unfortunately, even the most enthusiastic electronic data interchange (EDI) proponents may find themselves in that situation. Sure, the company is committed to EDI for exchanging important business documents, but will its partners go along? After all, there are only about 10,000 businesses currently using EDI, which hardly makes the technology universal. If your company's potential trading partners are not already thinking along EDI lines, you will have to invest time and money to sign them up.

In fact, a 1988 survey by Coopers & Lybrand found that trading partner conversion costs represented the single highest component (34%) of major EDI costs (see box, "The Cost of EDI Conversion").

Since educating and signing up trading partners is so expensive, companies need to find an efficient way to do it. This article offers five approaches. Each approach will attempt to perform two tasks: 1) determine the trading partner's knowledge, commitment, requirements and objections to EDI and 2) educate the trading partner as to the purpose, benefits and cost of EDI implementation.

Each description includes the primary steps needed to implement the approach, advantages and disadvantages and estimated time of completion. The time estimates are based on a company with 3,000 trading partners in 30 regions and 20 company representatives who establish contact with the trading partners.

1. Direct mail campaign. Mail an information packet to the contact person at each of your trading partners. The information should explain the purpose, benefits and costs of implementing EDI. It should also include a questionnaire that will help you assess the trading partner's knowledge, commitment, requirements and objections to using EDI.

Advantages of this alternative are that it is cost effective, that you can potentially contact 100% of your trading partners and will get written feedback.

Disadvantages are that you will probably receive less than a 100% response (30% would be considered high), the questionnaires may be slow to return and a trading partner might not be able to get a feel for your commitment or the other trading partners' commitment to EDI. You may also not be able to ascertain the true commitment of the trading partners.

Estimated time for completion is approximately one week for investigating trading partners' current EDI participation, three weeks for preparing the information packet and questionnaire, two weeks for testing the packet and questionnaire, two weeks for printing the packet and preparing it for mailing, six weeks for receiving the questionnaires back, two weeks for analyzing survey results and 12 weeks for pilot testing the EDI implementation. Total: 28 weeks.

2. Individual contact. Hold a rap session with the end users of each trading partner's company, one company at a time, and hand out questionnaires that you can analyze later. Present the purpose, benefits and cost of implementing EDI.

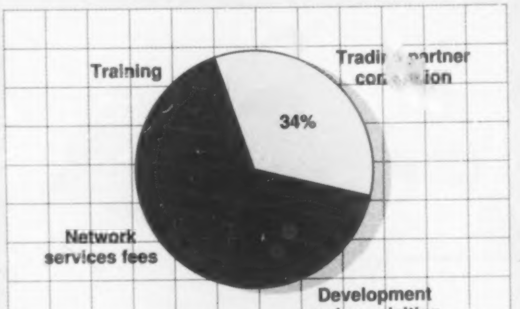
Advantages are that you can contact 100% of the trading partners, have maximum control over the quality of information given, receive a 100% response from your partners and react to their responses immediately.

Disadvantages are that it is the most costly approach and is potentially the most time-consuming method, depending on the number of contact representatives you have.

Estimated time periods for this approach are approximately one week for investigating trading partners' current EDI participation, three weeks for preparing information and questionnaire, two weeks for testing the packet and questionnaire, two weeks

The Cost Of EDI Conversion

Surprisingly, trading partner conversion accounts for the biggest share of every dollar spent implementing EDI.



Source: Coopers & Lybrand

for training the representatives to go out to the trading partners, 30 weeks for contacting each trading partner, two weeks for analyzing responses and 12 weeks for pilot testing EDI implementation. Total: 52 weeks.

3. Regional group seminars. Instead of contacting companies one at a time, you can hold a big group rap session with the contact people from a number of trading partners in an entire region. Distribute a questionnaire to get feedback.

The cost for this method is moderate, and group participation opens the way for expanding each trading partner's thinking about EDI.

However, fewer than 100% of the trading partners will attend, since finding a convenient time to gather all trading partners will be impossible. Responses to the questionnaires will be less personal if you distribute them in a group.

Estimated time periods for the regional group rap session approach are based on two-day seminars (two per week), 20 representatives (10 representatives per seminar), 30 regions and 100 participants per seminar. You will need approximately one week to investigate trading partners' current EDI participation, three weeks for preparing the information for the seminars, two weeks for training representatives, three weeks for contacting trading partners (phone and letter), 15 weeks for holding the seminars, two weeks for analyzing seminar responses and 12 weeks for pilot testing EDI implementation. Total: 38 weeks.

4. Select group. Hold a group meeting with the "top" trading partners—those providing 85% of your transaction volume. Then personally contact the top trading partners who were absent.

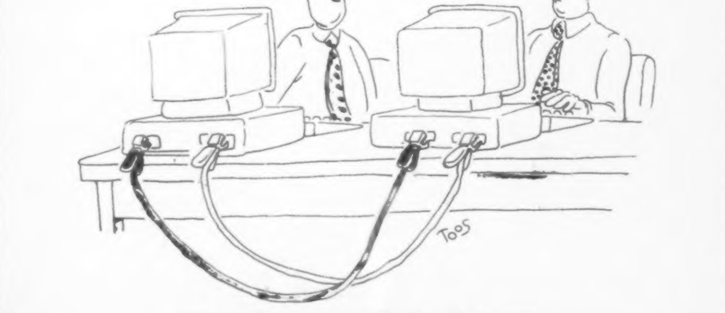
With this approach, you maximize your return on your investment. You expand the knowledge of the trading partners by having group discussion and feedback. You create a pilot group to test the new system, and you can have an up and running system in less time.

The disadvantage is that you contact fewer than 100% of the partners.

Estimated time periods expected for this alternative are based on having approximately 600 trading partners and holding 10 seminars with 10 representatives. You will need approximately one week for investigating trading partners' current EDI participation, three weeks for preparing the information packet, two weeks for training representatives, five weeks for holding seminars, two weeks for making personal contact with trading partners not attending a seminar, two weeks for analyzing the seminar results and 12 weeks for pilot testing EDI implementation. Total: 27 weeks.

☐ ONLY ABOUT 10,000 BUSINESSES ARE CURRENTLY USING EDI.

5. Combination of individual contact and regional group meetings. Visit the contact person from each of the top trading companies individually, giving a presentation of the purpose, benefits and costs for implementing EDI. Follow that with a rap session with the end users at each of these companies. Then back this up with regional group seminars with the smaller companies.



"Now, when we *really* start doing EDI, we won't have to sit next to each other."

This approach is cost effective in terms of both time and money. You have a chance to give immediate feedback to participants' responses. And you achieve a reasonable compromise in the quality of information you give.

However, fewer than 100% of the trading partners will attend the group seminar, and the responses will be less personal if a group-distributed questionnaire is used.

Estimated time period is one week for investigating trading partners' current EDI participation, three weeks for preparing the information, two weeks for training the representatives, six weeks for making individual contact, 12 weeks for holding group seminars, two weeks for analyzing results and 12 weeks for pilot testing EDI implementation. Total: 38 weeks.

Choosing The Best Way

In choosing among these five methods, consider cost, implementation time and the ability to convince trading partners to adopt EDI. Once you know the type, size and location of the trading partners; the transaction volume generated with those companies; and the number of representatives available from you company to handle the personal contact or seminars, you will be able to pinpoint the best approach for your company.

The constant costs for all of the alternatives include investigating current EDI participation, preparing EDI information, preparing the questionnaire, printing the information and the questionnaire and analyzing the responses.

The only additional expenses incurred by the direct mail campaign are for postage and envelopes. The other approaches have the added expenses of training representatives to make personal presentations, making phone calls and mailing a follow-up letter.

Approaches 2, 4 and 5 require additional expenses for making individual contacts with partners. Alternatives 3, 4 and 5 incur costs for seminars.

"Although technology is involved in EDI, the most important ingredient is people," says *The Petroleum EDI Digest.* "People implement EDI." Only when you work together with your trading partners will you reap the benefits of EDI. Isn't it time you and your trading partners take the first step in joining efforts to gain the strategic advantages of a paperless way of doing business?

Sharon Clark is a lecturer in MIS at Texas Christian University in Ft. Worth.

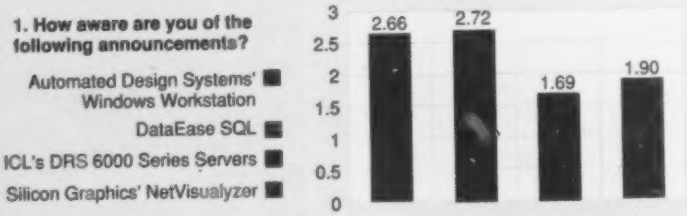
DATAMATION'S USER PRODUCT REVIEW

ADS's Windows Utility Gets High Marks

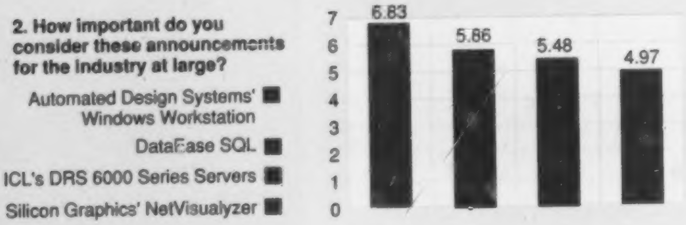
Pick of the Pack

The DATAMATION Review Panel was asked the following four questions for each product. Panel members were asked to respond on a scale of 1 to 10, with 1 meaning ""not very" and 10 meaning ""extremely." The results represent the average of all responses for each question.

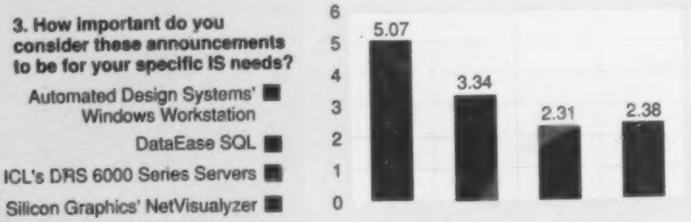
1. How aware are you of the following announcements?



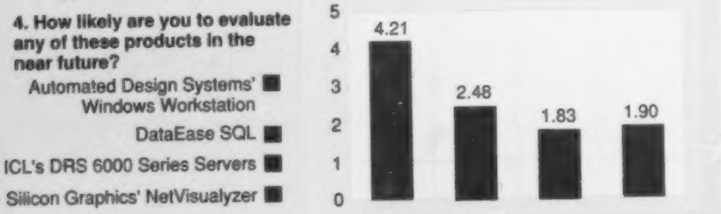
2. How important do you consider these announcements for the industry at large?



3. How important do you consider these announcements to be for your specific IS needs?



4. How likely are you to evaluate any of these products in the near future?



The Lineup

In August, **Silicon Graphics Computer Systems Inc.** of Mountain View, Calif., introduced the NetVisualyzer Data Station software for remote monitoring of network activity. Priced at $4,000, the software runs on the company's workstations and allows IS managers to track network traffic patterns, security breaches and changes in network configuration from one location.
Circle No. 590

Also announced in August was Windows Workstation, release 3 from **Automated Design Systems Inc.** of Atlanta. The Microsoft Windows 3.0-compatible set of software utilities is designed to make network connections and administration easier under the Windows operating environment. It is priced at $695.
Circle No. 591

International Computers Ltd. of Irvine, Calif., announced in August two new servers based on Sun Microsystems Inc.'s Scalable Processor Architecture (SPARC) Reduced Instruction Set Computing (RISC) architecture that run industry standard UNIX System V release 4.0. The company says the servers, priced from $160,000, let users run standard UNIX software packages on fast SPARC platforms.
Circle No. 592

Trumbull, Conn.-based **DataEase International Inc.** unveiled its DataEase SQL application development software for relational databases in August. The product allows users to access data in disparate databases transparently through Structured Query Language (SQL) in a client/server environment. Prices start at $995.
Circle No. 593

DATAMATION's User Product Review is conducted twice a month by a panel of the magazine's readers. Panel members base their judgments on published information about each of the products under review. Their responses are sent to DATAMATION by fax. If you wish to join the User Product Review Panel, call Bob Sawyer, Senior Editor, New Products, at (617)-558-4438; write to him at 275 Washington St., Newton, MA 02158; or fax him at (617)-558-4506.

Is An Upturn In The U.S. At Hand?

BY MADELINE FRANCHI
Cahners Economics

There's bad news and good news in DATAMATION's Information Systems Performance Indicator. Sad to say, our statistical amalgam of U.S. orders for computers and other economic indicators relevant to the computer industry hasn't been this low since early 1987. Happy to predict, however, the indicator should climb for the next 18 months—barring unforeseen events in the Persian Gulf.

The indicator has been descending since early 1989, when users began to rein in their information technology spending. They had good reasons. They could see that the engines of U.S. economic growth in the 1980s—financial services, real estate transactions and deregulation initiatives—were starting to sputter. They could see the advantages of investing in lower-priced distributed systems instead of big ticket host models.

In June, the latest month for which hard numbers (versus forecast) exist in DATAMATION's indicator, IS performance dropped to 100.7 with declines in three out of the indicator's five components. New U.S. orders for systems, one major component, slipped for the third straight month.

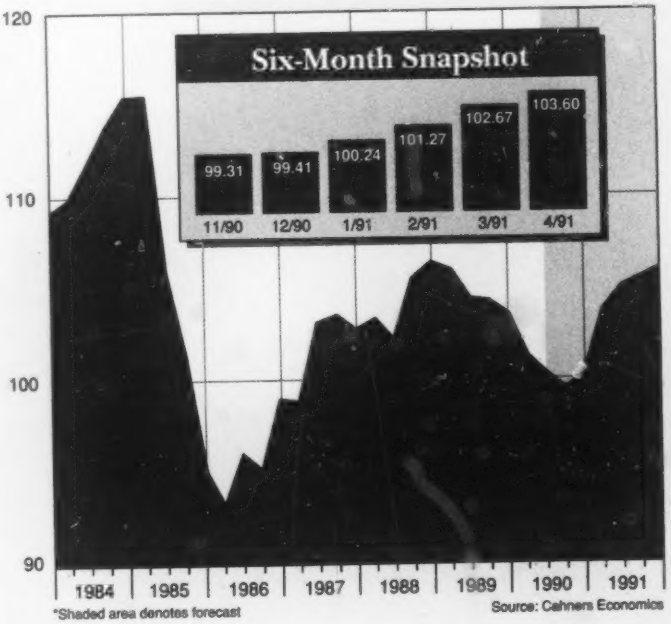
Evidence that another component, inventories at U.S. computer manufacturers, dipped in June was actually a good sign—one of many leading us to forecast a sustained recovery for the industry. Declining inventories signals that manufacturers are managing their businesses with foresight. They aren't suffering from an involuntary buildup of inventory, which would signal a more devastating and prolonged downturn. With inventory levels low, the anticipated pickup in demand in 1991 should trigger an immediate increase in production.

Methodology

The DATAMATION Information Systems Performance Indicator tracks the economic health of the IS industry. Cahners Economics developed this indicator, which is based on weighted moving growth rates for five statistics: (1) information systems inventory, (2) new IS orders, (3) average weekly hours of computer industry production workers, (4) Standard and Poor's computer system stock price index and (5) contracts and orders for plant and equipment. For more information on Cahners Economics's forecasting services contact Dan Buchan by phone at (617)-630-2105; by fax at (617)-630-2100; or write to him at Cahners Economics, 275 Washington Street, Newton, MA 02158.

The IS Performance Indicator

We should be at the bottom of a trough in the U.S. computer industry.



*Shaded area denotes forecast

Source: Cahners Economics

	June 1990	May 1990	% Change 5/90-6/90	June 1989	% Change 1989/1990
■ **Information-Processing Equipment**					
Shipments (SA, $ millions)	9,916	9,781	1.4	9,769	1.5
New Orders (SA, $ millions)	9,676	9,787	-1.1	8,833	9.5
Unfilled Orders (SA, $ millions)	28,346	28,586	-0.8	27,669	2.4
Inventory (SA, $ millions)	20,867	21,646	-3.6	21,548	-3.2
■ **Computer Production Workers**					
Employment (NSA, thousands)	126.3	124.8	1.2	129.7	-2.6
Average Weekly Hours (monthly avg.)	42.1	41.8	0.7	41.6	1.2
■ **Stock Index**					
S&P's Computer Systems Stock Price Index	196.31	191.97	2.3	190.95	2.8
■ **Contracts & Orders**					
New Plant & Equipment (SA, $ billions)	39.94	40.57	-1.6	44.07	-9.4

SA= seasonally adjusted;
NSA= nonseasonally adjusted

Sources: U.S. Commerce Dept. and Standard & Poor's; forecasts Cahners Economics

Software Engineering Tools Grip Users

BY WARREN CHILDS
Business Research Group

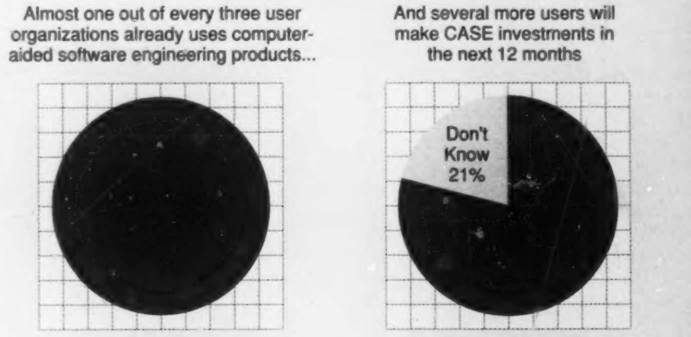
Hardly any other advance in information technology has caught on as fast as computer-aided software engineering. Large and medium-sized user organizations are investing in CASE tools by the droves, propelling the market to an estimated $2 billion in 1990.

More than a third of all the user organizations represented in DATAMATION's High Technology Panel already have bought CASE tools. Such interest is understandable given the potential of such tools to reduce the backlogs of requests within user organizations to develop new software applications—backlogs running as long as two years.

As useful as CASE tools appear to be, the money, training and time needed to implement them throughout a user organization are somewhat inhibiting. So while 36% of our panel members are using CASE products in some fashion, few are actually employing such engineering tools throughout their enterprises. Most are either just evaluating CASE tools they have purchased or applying them very selectively.

Understandably, those CASE tools that help at the beginning of software development—in the analysis and design phases—are more popular than ones targeted at other parts of the process. Almost twice as many CASE users have front-end tools than back-end products, which aid in programming, testing and maintenance of applications.

Users Make A Case For CASE



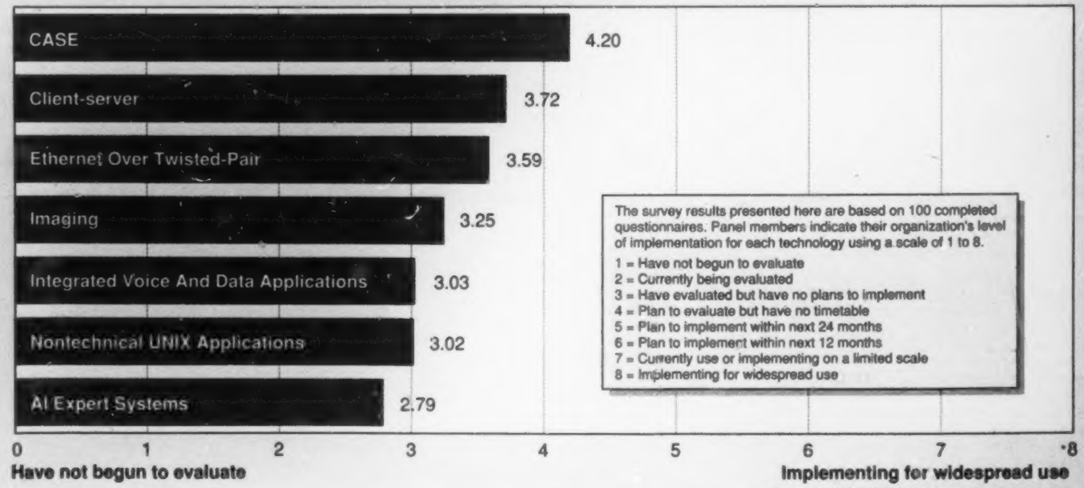
Almost one out of every three user organizations already uses computer-aided software engineering products...

And several more users will make CASE investments in the next 12 months

Source: DATAMATION/Business Research Group

DATAMATION's Technology Implementation Index

CASE leads the pack among new technologies that users intend to implement.
Right behind are client/server systems, networking and image products.



The survey results presented here are based on 100 completed questionnaires. Panel members indicate their organization's level of implementation for each technology using a scale of 1 to 8.

1 = Have not begun to evaluate
2 = Currently being evaluated
3 = Have evaluated but have no plans to implement
4 = Plan to evaluate but have no timetable
5 = Plan to implement within next 24 months
6 = Plan to implement within next 12 months
7 = Currently use or implementing on a limited scale
8 = Implementing for widespread use

Source: DATAMATION/Business Research Group

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FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE

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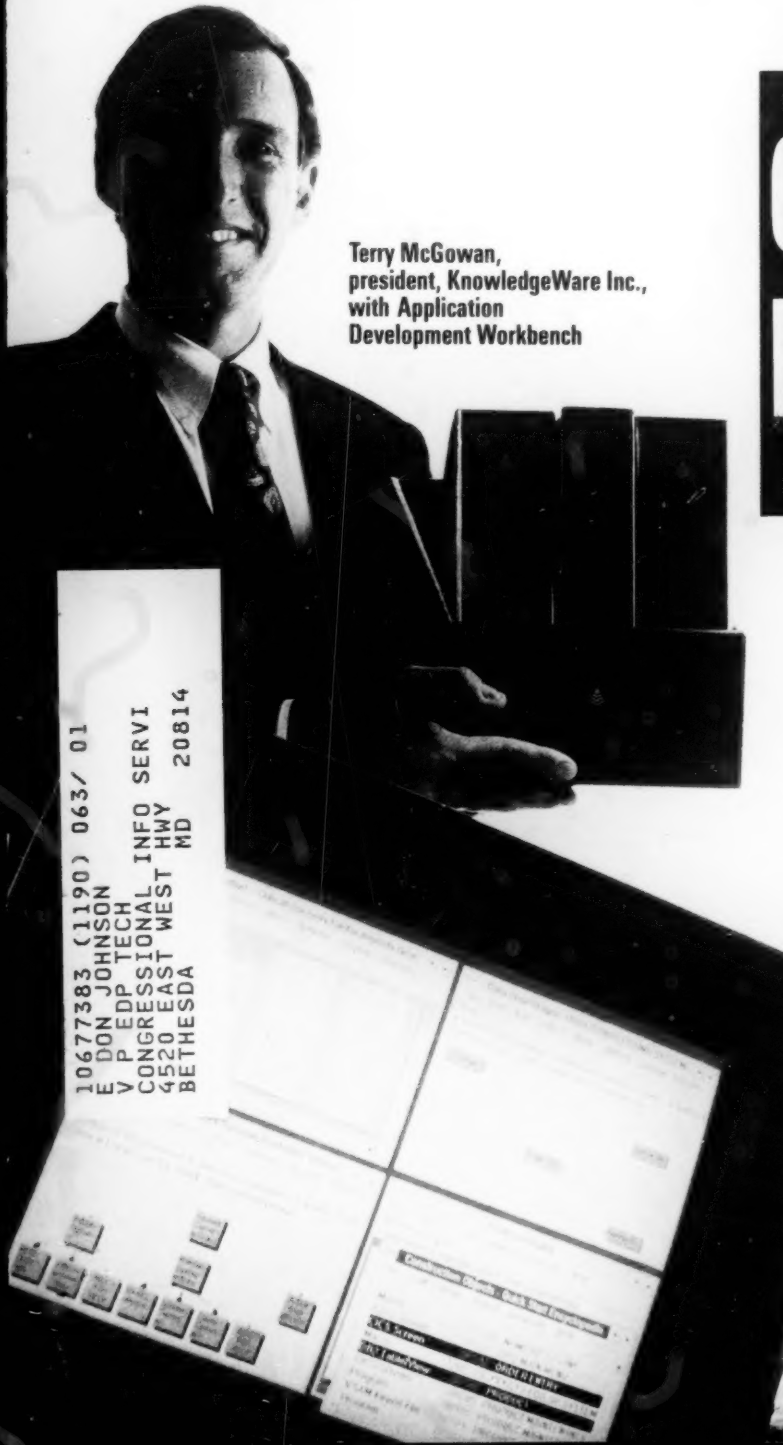

Terry McGowan,
president, KnowledgeWare Inc.,
with Application
Development Workbench

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BETHESDA MD 20814

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FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE

VOLUME 36
NUMBER 22

KnowledgeWare's ADW: the first OS/2 CASE tools for the pros.

COVER STORY

CASE Power For OS/2 34

BY J. WILLIAM SEMICH Undeterred by the furious frenzy of Windows-OS/2 wrestlemania, KnowledgeWare is first to launch CASE tools that run under OS/2, with its Application Development Workbench. ADW's biggest customer: IBM.

Cover photography by Chipp Jamison

SPECIAL REPORT

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Organizational Computing Arrives 42

BY PAUL PINELLA Networks will change forever the shape of U.S. computing. With the hardware and operating systems in place for companywide communications, IS managers say the stage is set for new networking applications to drive the enterprise.

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Apple Plays Up A Low-Cost Mac 101

BY MIKE RICCIUTI The Macintosh LC has a combination that Apple customers have long been waiting for: color and a low price tag.

Apple's Goins wants to put a Macintosh within everyone's reach.

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SECURITY

A Secure Future For Diskless Workstations 53

BY BOB FRANCIS Stung by data disaster stories and charged with responsibility for network security, more IS managers are seeking the sanctuary of diskless workstations. But not every user will want to go diskless anytime soon.

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OS/2's Multiuser Migration 63

BY BOB FRANCIS From the beginning, one of the brickbats most often hurled at OS/2 has been its lack of multiuser capabilities. Following the release of this customized OS/2 version, that criticism won't be true any more.

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Macs Get A VAX Connection 69

BY MARK SCHLACK The long-awaited product of the Digital/Apple joint development project, DEC LanWORKS for Macintosh, achieves a high level of integration between the Mac and VAX worlds.

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Financial Systems That Bust Borders 77

BY RALPH CARLYLE If your vanilla-flavored financial management system doesn't know a Krone from a Krona, a Riyal from a Ringgit or a Peso from a Pesata, you need this guide to picking the right international financial applications.

RELATIONAL DATABASES

Which Database For Digital's Customers? 87

BY JEFF MOAD Just try to pin Digital down. One day the company thinks it's selling only its proprietary Rdb database product; the next it's out with its database competitors trying to sell their products.

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DATA CENTER AUTOMATION

IS Automates For Data Center Survival 95

BY DWIGHT B. DAVIS Data center managers are sizing up a myriad of automation products. Here is DATAMATION's guide through the maze of products designed to light up your life by keeping your data center's lights out.

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Colonial's Archer looks for a clear Digital strategy, page 87.

Capital Bank's Rodriguez keeps ATMs going, page 95.

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Organizational Computing Arrives

Networks will change forever the shape of U.S. computing. With the hardware and operating systems in place for companywide communications, IS managers say the stage is set for new networking applications to drive the enterprise.

BY PAUL PINELLA

The much talked and written about age of network computing is finally beginning to dawn.

That networks are beginning to play a significant role in the way corporations compute at all levels is a major conclusion reached from examining this year's DATAMATION/Cowen & Co. Mini/Micro survey. Based on the answers to questions sent to over 66,000 DATAMATION subscribers last summer, the survey documents a dramatic shift toward networks driven largely by the irresistible allure of specific applications. Jim Manzi, president and chief executive of Lotus Development Corp. in Cambridge, Mass., has described this trend as "organizational computing."

The evidence for this trend is overwhelming. By next year, over 80% of respondents indicating that they have a network say they'll have peripherals-sharing and file transfer applications in place on them, up from the 60% who are using them now. Beyond 1991, 82% of users see networks delivering electronic mail throughout their companies—way up from today's 44%—and 68% expect to be using groupware applications, despite today's limited software selection.

Clearly, the shift toward organizational computing is part of the equally dramatic shift toward desktop systems that was also documented in last year's survey (see "The Desktop Dimension," November 1, 1989, p. 28). For the second year in the 14-year history of our annual survey measuring U.S. users' intentions to buy mini and microcomputers, the dollar value of minicomputer shipments is expected to decline by 8%. Meanwhile, investments in microcomputer systems—particularly workstations and laptop PCs—continue to climb. The dollar value of PC shipments is expected to grow by 8% this year, although unit shipment growth will slow to 3%. Workstation shipments should soar by a healthy 31% in dollar terms, driven largely by strong Sun Microsystems Inc.'s products and increasing interest in IBM's RS/6000 family.

Plans to meld distributed systems into sitewide or organizationwide networks are apparent among survey respondents. Already, 52% of sites have departmental networks and 30% have sitewide networks. Longer term, at some point after 1991, 60% of all users expect to have organizationwide networks in their firms.

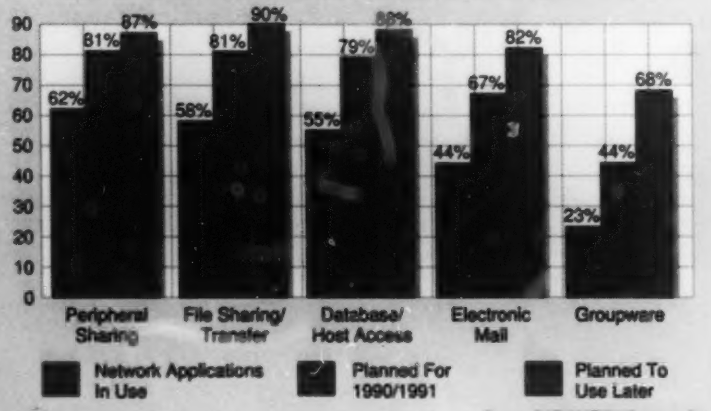
In support of the shift toward networks and organizational computing, this year's survey reveals the following trends:

- A continued growth in organizationwide networks, particularly as departmental networks become commonplace.
- An increasing reliance on UNIX and re-

Software Drives The Networking Market

Users are becoming increasingly drawn to network-capable applications such as electronic mail, host access and groupware.

% OF SITES EMPLOYING PARTICULAR NETWORK APPLICATIONS



Source: DATAMATION/Cowen & Co.

duced instruction set computing (RISC) as the software and hardware engines of choice driving organizational computing.

- Strong growth in high-end network servers from industry leaders Compaq Computer Corp., IBM and Sun.
- Big gains for software suppliers able to meet customer demands for interoperable applications across multiple platforms.

A Nation Of Networks

Many industry observers believe the shift toward organizational computing is largely a networking phenomenon. "Downsizing and open systems are enabled in large part by networks," says Chris Mines, a Cowen & Co. analyst. As networks become the glue that holds companywide computer systems together, leading vendors of PC local area networks are hoping to move upscale with their products and establish solid mini and mainframe connections. Meanwhile, leading mainframe and minicomputer companies are moving in the opposite direction in an all-out embrace of PCs.

90 RESEARCH

MINI MICRO SURVEY

For example, just how well Provo, Utah-based Novell Inc. will be able to switch gears from a PC-oriented vendor to an organizational computing company is open to question, despite the company's potential success next year with NetWare 386 and its toehold in client/server technology gained through an equity investment in database supplier Gupta Technologies Inc. Because the LAN business is relatively new, there's still time for another player to grab market share. Possible contenders include Microsoft Corp., through its new army of LAN Manager 2.0 recruits, or old standbys Digital and IBM, both of which show staying power in organizationwide networks.

No matter which network operating system eventually prevails, the strength in the still-embryonic market for client/server databases lies with Oracle Corp., despite gains by Microsoft's SQL Server. Some 43% of users plan to stick with the server version of Redwood Shores, Calif.-based Oracle's database product to meet their client/server database needs in 1990/1991.

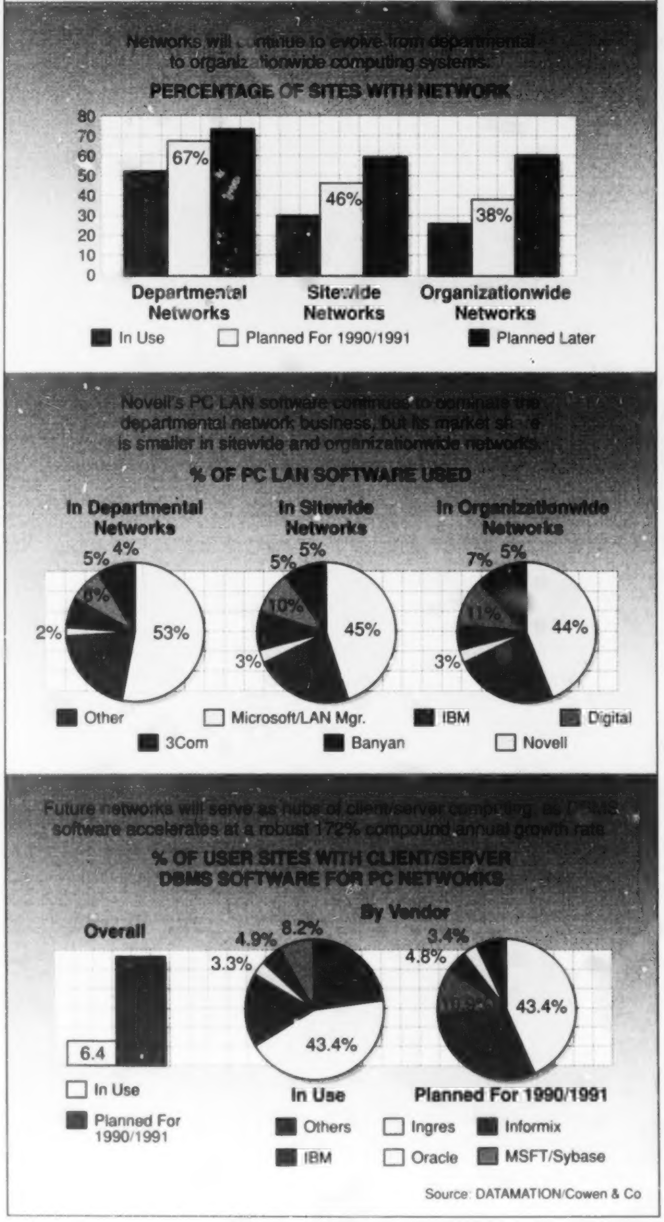
UNIX: At Home On The Midrange

Oracle also appears strong among survey respondents as a preferred database supplier for UNIX-based minicomputers. But the company is expected to lose ground among users of Digital minicomputers: while 24.8% of Digital users say they are using Oracle today, only 19.6% are planning to buy it during 1990/1991. One possible explanation for the decline: the bundling of Digital's own Rdb product with new minicomputer sales.

As interest in organizational computing accelerates, and with it a concomitant interest in open systems, survey respondents increasingly see UNIX as the most likely operating system to capture the midrange and workstation markets. By next year, nearly half of all respondents' systems in technical settings will be running UNIX, compared with 33.8%, and nearly 24% of all commercial sites are planning to use it, compared with 14% now.

Of particular interest here is the growth rate of UNIX in the commercial sector. While proprietary operating systems still command the greatest share of commercial sites, UNIX is spreading at an 18-month compound growth rate of 40% among commercial users. Original equipment manufacturers

Networks Move To Center Stage



Networks will continue to evolve from departmental to organizationwide computing systems.

PERCENTAGE OF SITES WITH NETWORK

Novell's PC LAN software continues to dominate the departmental network business, but its market share is smaller in sitewide and organizationwide networks.

% OF PC LAN SOFTWARE USED

Future networks will serve as hubs of client/server computing, as DBMS software accelerates at a robust 172% compound annual growth rate.

% OF USER SITES WITH CLIENT/SERVER DBMS SOFTWARE FOR PC NETWORKS

Source: DATAMATION/Cowen & Co

duced instruction set computing (RISC) as the software and hardware engines of choice driving organizational computing.

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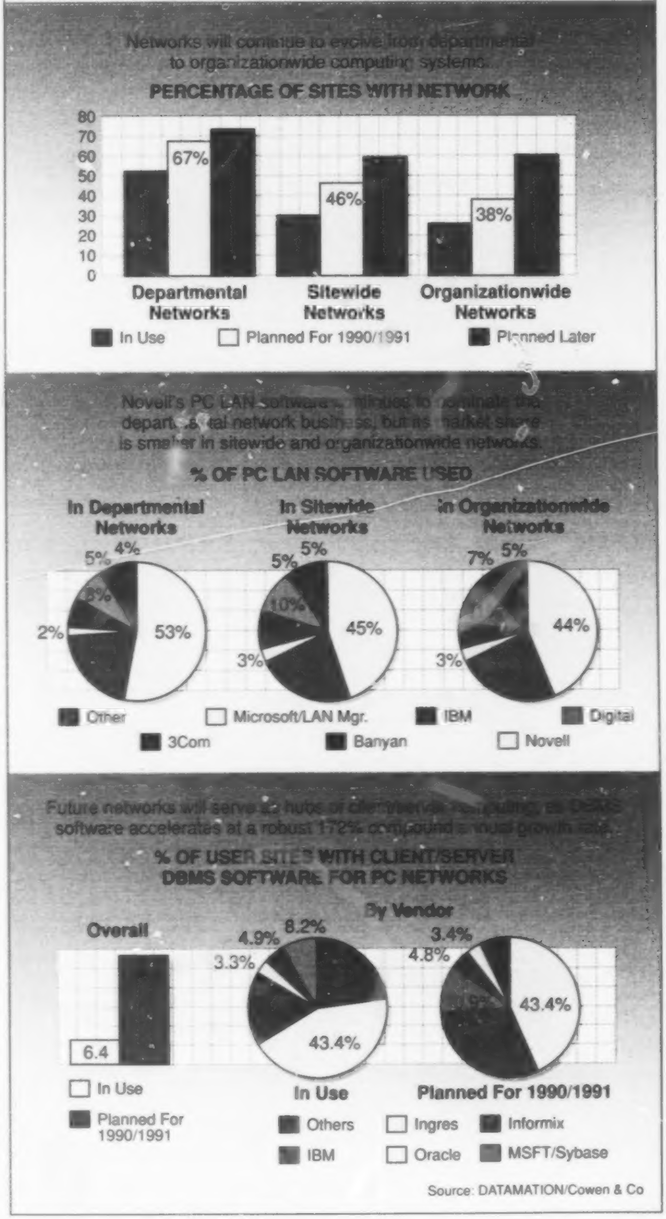
Networks Move To Center Stage



Source: DATAMATION/Cowen & Co

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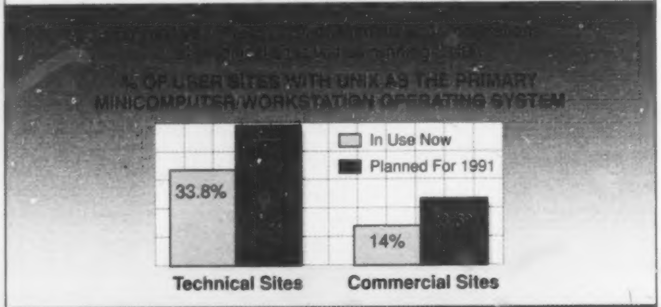
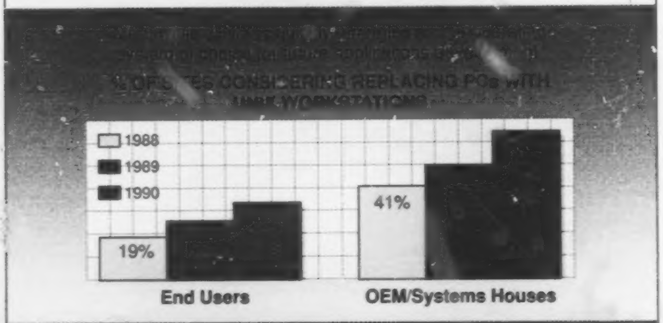
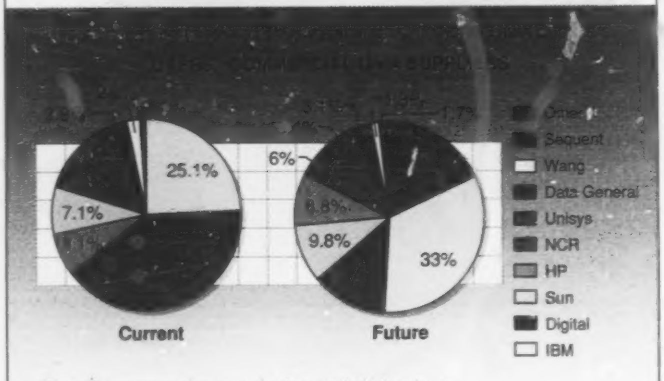
UNIX Fuels The Enterprise







*Note: These same sites may also have technical systems.

Source: DATAMATION/Cowen & Co.

(OEMs) and systems houses are embracing UNIX even faster. For next year, 65% of them indicated they would be UNIX resellers in the future (1991 and beyond).

One explanation for the surge in popularity of this 21-year-old operating system is the equally stunning shift toward multiprocessor midrange systems. With announcements of RISC- and complex instruction set computing (CISC)-based products becoming commonplace, UNIX has emerged as the only operating system flexible enough to port to practically any platform, including a new generation of transaction-processing systems from NCR Corp., Sequent Computer Systems Inc., Stratus Computer Inc. and Tandem Computers Inc. "We believed in UNIX five years ago," says Tandem's president, Jim Treybig, whose company announced a UNIX-based multiprocessor system earlier this year. "The mainframe of the future will be RISC technology."

Although UNIX enjoys a reputation for openness, users are becoming increasingly closed-minded about whom they choose as their UNIX supplier. The big four—IBM, Digital, Sun and Hewlett-Packard Co.—will capture close to 65% of the commercial systems market in future years, leaving Data General Corp., NCR, Sequent, Unisys Corp., Wang Laboratories Inc. and smaller competitors to fight over the remaining market. But even Digital's spot in the top tier of UNIX suppliers is by no means assured. Among survey respondents in the UNIX commercial arena, 15.1% cite Digital as their current UNIX systems supplier, but this number drops to 12.9% when respondents were asked about their future plans.

Although UNIX is likely to remain popular on multiuser midrange systems for years to come, even greater growth is coming from workstations running UNIX. This year and next, users estimate that 45% of their new application development projects will be workstation- or PC-based. Longer term, more than half of all organizationwide applications will be established on desktop systems. As users begin to evaluate powerful workstation offerings from the UNIX industry leaders—IBM customers in particular seem poised to acquire RS/6000s in large numbers—this trend is likely to accelerate. Based on the survey findings, the IBM RS/6000 alone will account for sales in excess of $1 billion next year.

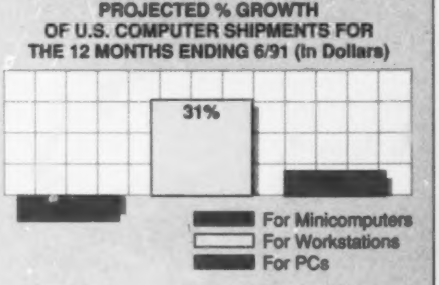
The Prognosis For PCs

Perhaps no single machine defines organizational computing as much as the personal computer. Office PCs have quickly made the transition from the 64-kilobyte CP/M machines of the early 1980s to today's orders-of-magnitude more powerful desktop, and even laptop, systems with network connections.

The desktop industry is ruled by Intel microprocessor-based machines that are growing more powerful. Next year, users say that roughly half of all purchases will be for 80386 or 80386SX-based PCs, which can run more sophisticated operating environments such as Microsoft Windows or at some point OS/2. By June of 1991, 29% of all 80386 pur-

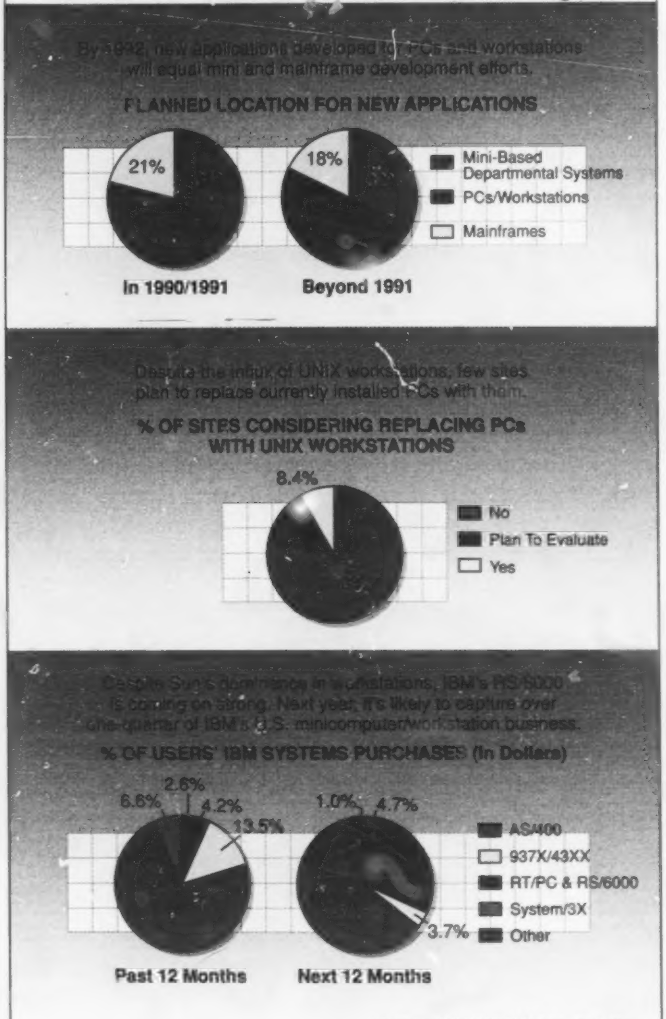
The Desktop Drive Toward Organizational Computing

In terms of growth, minicomputer shipments will shrink for the second year in a row as PCs moderate and workstations soar.



Source: DATAMATION/Cowen & Co.

Workstations Dominate Downsizing



By 1992, new applications developed for PCs and workstations will equal mini and mainframe development efforts.

PLANNED LOCATION FOR NEW APPLICATIONS

Despite the influx of UNIX workstations, few sites plan to replace currently installed PCs with them.

% OF SITES CONSIDERING REPLACING PCs WITH UNIX WORKSTATIONS

Despite Sun's dominance in workstations, IBM's RS/6000 is coming on strong. Next year, it's likely to capture over one-quarter of IBM's U.S. minicomputer/workstation business.

% OF USERS' IBM SYSTEMS PURCHASES (In Dollars)

Source: DATAMATION/Cowen & Co.

chases will be awarded to IBM (down from the previous 12 month's 32%), 18% to Compaq (down from 20%) and 6% to Everex (down from 8%). The only significant non-Intel based system—the Apple Macintosh—will capture 8% of buys among sites planning to purchase PCs next year, a figure essentially unchanged from 1989.

But, with a 35% market share, the biggest winner in the 386 category belongs to "other," or the PC clones, which advanced 6% from the prior 12 month figure. This trend apparently reflects management's rising commodity view of the PC market and sensitivity toward price, which in another part of the survey users ranked as more important than product reputation, compatibility or supplier viability. "Price continues to become an increasingly important criterion," says Cowen & Co. analyst Michele Preston.

In yet another bit of evidence indicating a growing disinterest in PC brand-name purchasing, only half of users at all surveyed sites feel the need to standardize future PC purchases around any one supplier.

As the need for more powerful PCs becomes more apparent, the era of the hand-me-down machine is drawing to a close, and a replacement cycle is beginning. This year, only about 59% of users say that earlier-generation machines will be used elsewhere in the organization. Last year, nearly 74% said they would keep using the old machines. When PCs become obsolete, more of them are being retired, sold, traded in or simply given away to make way for their more capable replacements.

Year Of The Laptop

Although the growth in PC shipments is actually decelerating (last year's growth projection was 11% compared with this year's 8%), survey respondents' plans to buy laptops reveal a market segment with much potential. According to the survey, laptop shipments will swell by more than 60% over 1990 levels. Some of the rise can be attributed to what heretofore has been a small installed base. But, in addition, IS managers are telegraphing suppliers that their products have finally met requirements for usefulness, compatibility, price and performance.

Further laptop improvements expected in 1991—for example, Intel's refinement of the 80386SX chip and Japan's perfection of high-quality, flat panel displays—are expected to push this market to even greater heights. Users have chosen Compaq to be their No. 1 laptop supplier for the 12 months ending in June 1991 (27% of indicated unit purchases, up from the prior 12 months' 21%), followed by Toshiba Corp. (22%, from 29.3%) and Zenith Data Systems Corp. (16%, down from 28%).

Organizational Software

No pioneering applications emerge in the survey to shake the industry in the same way that Aldus Corp.'s PageMaker desktop publishing package or Lotus Development Corp.'s 1-2-3 spreadsheet software once did. The one software star that does stand out in the 1990 survey—is Microsoft Windows 3.0. IBM PC and compatible users estimate that 23% of their future (1991 and beyond) PC operating system use will be Windows, which should drive growth for other application packages.

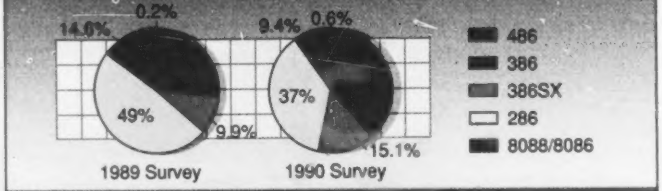
Still, a few notable, albeit subtle, software shifts are apparent. In the spreadsheet department, users say that industry leader Lotus, now with 75% of the market, will eventually hand over about 13% of its share to Borland International Inc.'s Quattro Pro and Microsoft's Excel. A similar transition is under way in databases; while Ashton-Tate Corp.'s dBASE product currently commands 52% of the database market, managers expect that situation to change as Borland snaps up 15% with its Paradox and Reflex products.

Rather than creating dazzling new applications, leading developers are directing their energies toward porting their applications to a variety of platforms. Following the premise that users want organizational applications that look and feel the same

The Shift Toward Power PCs

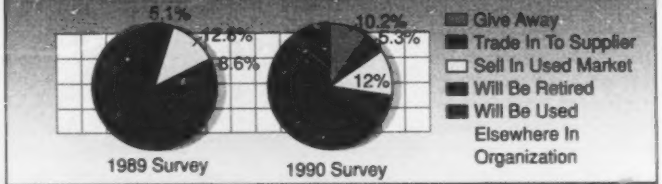
[illegible] 80386SX chips; less than 1% of users are ready to buy the even more powerful--but expensive--80486-based PCs.

PLANNED PC PURCHASES



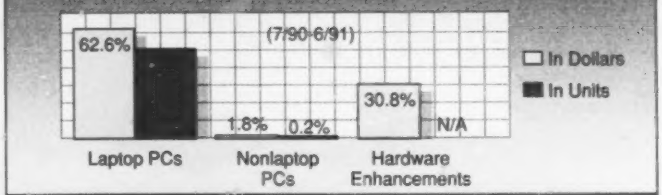
[illegible] earlier-generation machines.

DISPOSITION OF OLD PCs



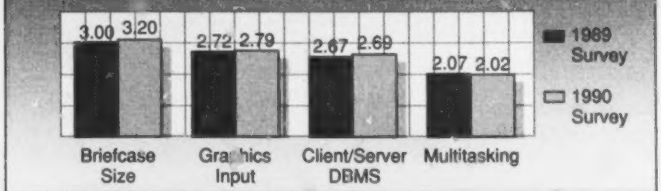
[illegible] for the 12 months ending 6/91 tops 50%. Upgrade expenditures will also grow significantly.

PROJECTED % GROWTH OF SHIPMENTS



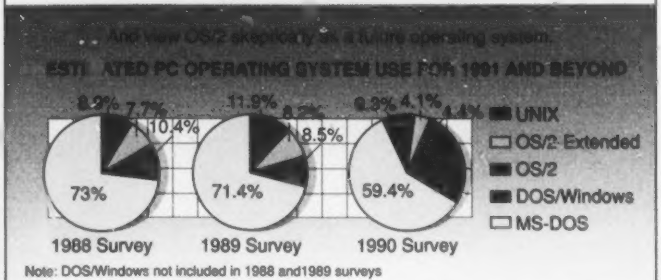
[illegible] desired feature for future PCs...

MOST DESIRED FEATURE FOR FUTURE PCs (ON A SCALE OF 1 TO 5 WHERE 1 IS MOST DESIRABLE)



. . . And view OS/2 skeptically as a future operating system.

ESTIMATED PC OPERATING SYSTEM USE FOR 1991 AND BEYOND



Note: DOS/Windows not included in 1988 and1989 surveys

Source: DATAMATION/Cowen & Co.

across platforms—and can share data easily between them—developers such as Informix Software Inc., Aldus Corp., Lotus, Microsoft, Symantec Corp. and WordPerfect Corp. are beginning to introduce product families that do indeed work much the same on IBM PC compatibles, Apple Macintoshes and even a few UNIX machines. "A cross-platform strategy is very important," stresses Mort Rosenthal, chairman and chief executive officer of Corporate Software Inc., a Canton, Mass.-based software and services firm catering to large companies.

Microsoft Windows 3.0 is the most obvious beneficiary of a cross-platform strategy. By delivering the closest interface yet to a Macintosh environment on PCs, Windows has already prompted a number of developers to introduce both Macintosh and PC versions of their products. Windows also offers multitasking on 80386-based PCs, a feature that surveyed users rank ahead of client/server databases, graphics input or briefcase-sized computing in importance for longer term future PC usage. Users forecast that Windows will be running on close to 23% of all business PCs next year.

As Windows begins to give PC users a transition into a multitasking, graphical environment, and as workstations begin to move down into productivity markets once dominated by PCs, the lines between the two will continue to blur. "The separate world of PCs and workstations is not so separate anymore," says Jim Cannavino, president of IBM's entry systems division.

Nevertheless, only 8% of users anticipate replacing their existing PCs with workstations, and another 14% plan to evaluate replacement. The majority still see the two types of desktop systems living and communicating side by side—in true organizational computing style—for perhaps years to come. ▭

Survey results are available to the public and include over 200 pages of industry-related charts and graphs. For more information, contact Nancy Finn, Business Research Group, 275 Washington St., Newton, MA 02158. Phone: (617)-964-6204, fax: (617)-558-4402.

Survey Methods

The 15th Annual DATAMATION/Cowen & Co. Mini/Micro survey is based on 4,062 reader survey questionnaires returned following a mass mailing last summer to more than 66,000 DATAMATION subscribers. The survey is administered by Cowen & Co.-Institutional Services, a financial securities firm whose Boston and New York-based research team specializes in high-technology and health care-related companies. This year's sample combines user responses from a wide cross-section of industries, including manufacturing, business services and government. Although the survey does not constitute a scientific sampling of the U.S. user community, the results do highlight general directions IS managers are moving their organizations in the year ahead.

DATAMATION'S

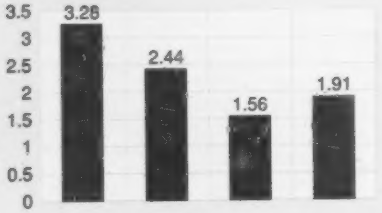
USER PRODUCT
REVIEW

A Grid Lock On The Top Spot

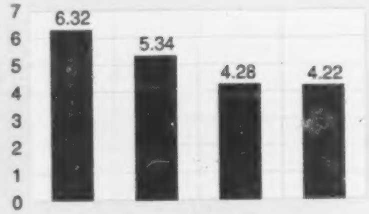
Pick Of The Pack

The DATAMATION Review Panel was asked the following four questions for each product. Panel members were asked to respond on a scale of 1 to 10, with 1 meaning ""not very" and 10 meaning ""extremely."
The results represent the average of all responses for each question.

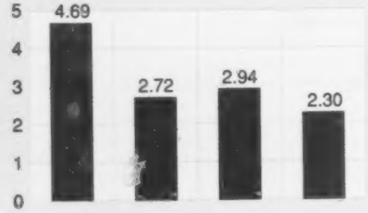
1. How aware are you of the following announcements?



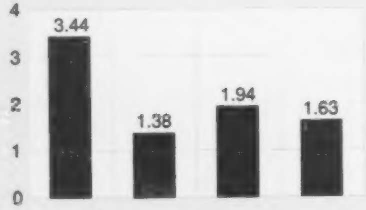
2. How important do you consider these announcements for the industry at large?



3. How important do you consider these announcements for your IS needs specifically?



4. How likely are you to evaluate any of these products in the near future?



The Lineup

GRiD Systems Corp. of Fremont, Calif., introduced the GRiDCASE 1550sx, a laptop computer with a built-in mouse-compatible input device for use with graphical software. The 12-pound laptop comes standard with a 60-megabyte hard disk, a 20-megahertz 80386sx microprocessor, an input device and 2MB of internal memory. It is priced at $6,295.

Circle No. 590

The HP 9000 model 860S minicomputer was introduced by Palo Alto-based **Hewlett-Packard Co.** The system is designed for on-line transaction-processing applications in accounting, inventory management, sales and order processing. The system is priced at $291,000.

Circle No. 591

Minneapolis-based **Lawson Associates Inc.** introduced two new computer-aided software engineering (CASE) tools in its UNIVERSE line of software products. UNIVERSE/CASE and UNIVERSE/Report Writer work with Lawson's PINSTRIPE and PINPOINT software packages. Prices for the software start at $12,000.

Circle No. 592

Prime Computer Inc. introduced the PRIME EXL 7000 series systems based on reduced instruction set computing technology (RISC). The Natick, Mass.-based company offers four models in the series, ranging from the PRIME EXL 7330, at $18,000—a deskside server rated at 25 million instructions per second (MIPS)—to the EXL 7680, a 68 MIPS multiuser system, priced at more than $150,000.

Circle No. 593

DATAMATION'S User Product Review is conducted twice a month by a panel of the magazine's readers. Panel members base their judgments on published information about each of the products under review. Their responses are sent to DATAMATION by fax. If you wish to join DATAMATION'S User Product Review Panel, call Mike Ricciuti, New Products, at (617)-558-4308; write to him at 275 Washington St., Newton, MA 02158; or fax him at (617)-558-4506.

MARKET INSIGHTS

AN ANALYSIS OF ECONOMIC TRENDS

Computer Industry Hangs Tough

BY MADELINE FRANCHI
Cahners Economics

The current anemic pace of economic growth stems in part from the business community's uncertainty about which direction the manufacturing sector will take in the next few quarters. With profits depressed and interest rates still relatively high, some capital-spending plans have been shelved. This pullback in investment spending has hit some original equipment manufacturers (OEMs) hard, while others have just slowed down.

The computer industry is exhibiting the strains of the business cycle downturn and the uncertain future. Output from the nation's computer and office equipment manufacturers was 1.5% lower in July of this year than it was in June (according to seasonally adjusted figures). Still, production was 6.5% higher than it had been in July of the previous year.

Clearly, the industry is adjusting to a new set of rules, with new players and different game boards.

One new rule: keep inventories under tight control. The current economic slowdown could have been more jarring if the industry had over built inventory during 1988 and 1989. Instead, inventory-to-shipment ratios remained fairly stable and certainly well below the highs of 1985.

Another rule: Take advantage of opportunities in foreign markets. Last year, U.S. computer hardware manufacturers received 40 to 50% of their revenues, on average, from foreign sales.

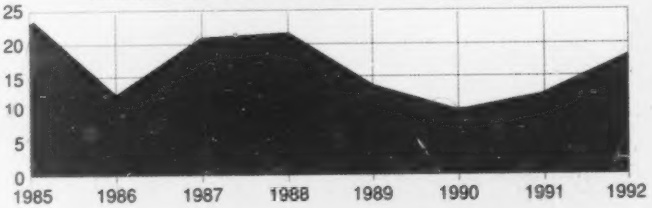
Although the economy looks a bit bleak now, new order activity is picking up. Cahners Economics predicts that the computer industry will begin pushing up production growth a little more in response to the rekindling of domestic investment. Cahners Economics forecasts output to expand 11.6% in 1991 and 17.5% in 1992.

For more information on Cahners Economics's forecasting services, contact Dan Buchanan at (617)-630-2105, by fax at (617)-630-2100 or write to him at Cahners Economics, 275 Washington Street, Newton, MA 02158.

Computer Production Growth Slows; Inventories Stable

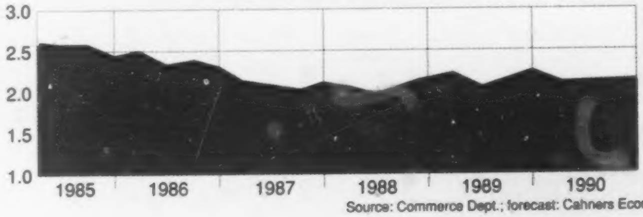
The growth rate in the production of computers is expected to drop to 9.5% this year, but rise to 11.6% next year.

ANNUAL % GROWTH IN COMPUTER PRODUCTION



Computer inventories are projected to stabilize in the third and fourth quarters.

COMPUTER AND OFFICE EQUIPMENT: INVENTORY-TO-SHIPMENTS RATIO



Source: Commerce Dept.; forecast: Cahners Economics

	Actual		Forecast (Annual % growth)		
	Q1/90	Q2/90	1990	1991	1992
Gross National Product	1.7	1.2	1.4	2.3	2.2
Business Investment In Equipment	5.7	-6.2	1.4	4.6	3.3
Government Spending	2.9	6.2	2.0	1.3	0.5
Consumer Spending	1.1	-0.2	1.0	2.0	2.1
Exports	8.3	-2.8	6.0	3.3	4.7
Imports	1.9	3.2	3.5	2.2	2.9

All calculations are % growth in 1982 dollars; quarterly figures are seasonally adjusted annual rates.

	July 1990	June 1990	% Change 6/90-7/90	June 1989	% Change 1989/1990
Manufacturing Production (1)					
Process Industries Total	109.1	108.5	0.6	108.1	0.9
Chemicals	110.4	110.0	0.4	109.7	0.6
Petroleum	109.6	107.8	1.7	108.2	1.3
OEM Total	114.2	114.9	-0.6	111.9	2.1
Computers & Peripherals	146.0	148.2	-1.5	137.1	6.5
Communication Equipment	110.9	110.8	0.1	106.0	4.6
Transportation Equipment	108.8	110.9	-1.9	106.6	2.1
Services Employment (2)					
Finance, Insurance, Real Estate	6.937	6.915	0.3	6.817	1.8
Health Care	8.174	8.129	0.6	7.598	7.6
Computer & Data Processing	0.804	0.801	0.4	0.754	6.6
Transportation/Utilities	5.842	5.881	-0.7	5.675	2.9
Retail Trade	19.946	19.981	-0.2	19.673	1.4
Wholesale Trade	6.417	6.420	0.0	6.315	1.6
Government	17.478	18.624	-6.2	16.844	3.8

(1) Index 1978=100, seasonally adjusted
(2) Millions of persons, not seasonally adjusted

Source: Commerce Dept.; forecast: Cahners Economics

MARKET INSIGHTS

A SURVEY OF TECHNOLOGY TRENDS

It's Still Early In The Game For UNIX

BY WARREN CHILDS
Business Research Group

Despite the push on several fronts, UNIX has yet to become a significant operating system in the commercial market.

A survey of the 500-member DATAMATION High-Technology Panel shows that 27% of the 276 respondents are currently using UNIX-based systems for some nontechnical applications. Of the 73% who do not currently use UNIX for nontechnical applications, 11% plan to do so within the next 12 months.

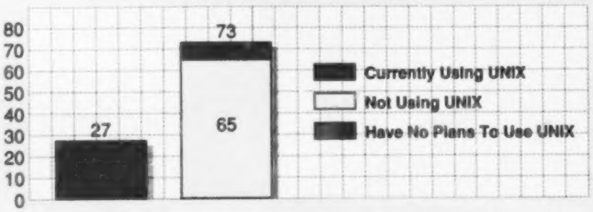
Part of the push for UNIX is coming from workstation vendors whose UNIX-based systems are well established in the technical/engineering market. These vendors are now looking to the commercial market to expand sales. In addition, many of these vendors are pushing UNIX-based open systems for office automation applications. But obstacles such as the lack of a single UNIX standard and an entrenched base of DOS systems and application software have prevented UNIX from gaining a strong foothold in the commercial market.

Meanwhile, two factions are currently competing to develop an industry standard for UNIX. These are the Open Software Foundation (OSF) and UNIX International Inc. The DATAMATION High-Technology Panel reveals that, by almost a two to one margin, users prefer the OSF version over UNIX International's as their organizations' UNIX standard. ▭

How The UNIX Commercial World Shapes Up

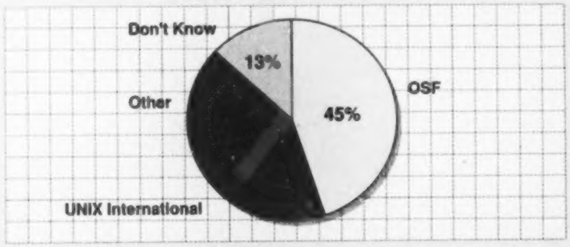
Many commercial users are still cool to UNIX...

COMMERCIAL UNIX USE



But those warming up side with OSF

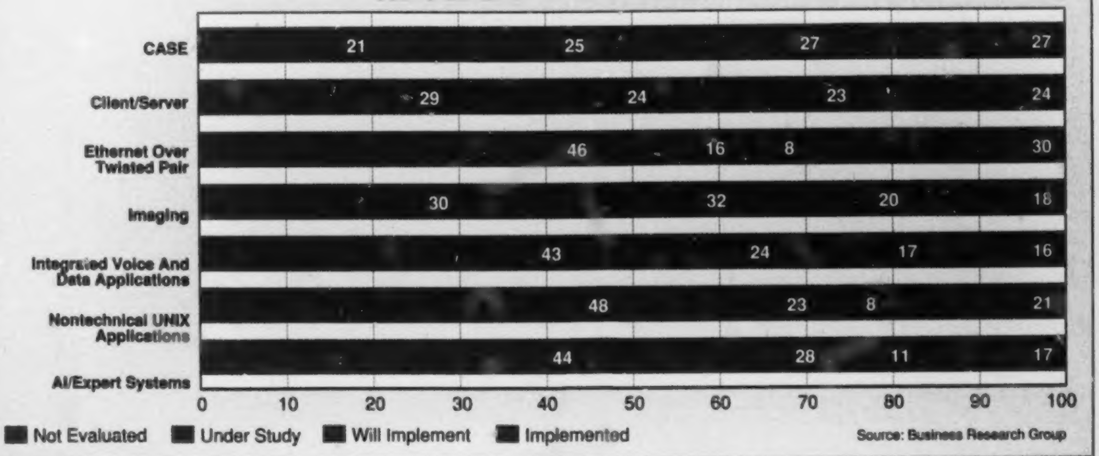
EXPECTED UNIX STANDARD



DATAMATION's Technology Implementation Index

DATAMATION each month surveys a select group of its readers–the DATAMATION High Technology Panel–to investigate the implementation of new technologies by key user organizations.

USERS' LEVEL OF IMPLEMENTATION



Source: Business Research Group

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A CAHNERS PUBLICATION

140 TOTAL PAGES

DATAMATION

FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE

DECEMBER 1, 1990

Philip Neches, Chief Scientist &
Charles Exley, Chairman, NCR Corp.,
with the System 3000

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DECEMBER 1, 1990

DATAMATION

VOLUME 36
NUMBER 23

FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE

The 486 PC is only one part of an entire new line of Intel-based products, called the System 3000.

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PCs & WORKSTATIONS

NCR's 486 Strategy 34

BY JEFF MOAD Seven months after announcing one of the most powerful PCs ever, NCR is gambling its entire future on Intel-based multiprocessor systems. The company's vision of scalable systems is real. But all of the software isn't.

Cover photography by Kenneth Hayden/Black Star

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Software's BIG 50 67

BY LEILA DAVIS
Recession? Not yet for software; sales are booming. As IS managers look to cut costs and boost efficiency, they're turning in droves to software vendors with solutions for sale.

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AT&T's Network Star 91

BY MIKE RICCIUTI
StarGROUP Server for Macintosh software allows networked Macs to share files and printers with MS-DOS, OS/2 and UNIX system users.

StarGROUP ties it all together, says AT&T's product manager, Mike Sloan.

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LAN Manager Grows Up 53

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Ten Steps To AD/Cycle 59

BY HOWARD FOSDICK Not quite ready for IBM's AD/Cycle? Not even sure what the Repository is? Follow these 10 steps, and you'll be all set for IBM's CASE applications development system—without spending a bundle.

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BY JOHN McMULLEN The Macintosh's lingering reputation as a database Milquetoast is slowly dissolving because leading products are proving their mettle as high-end development tools.

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Survival Software For Manufacturing 81

BY DAVID STAMPS Large manufacturers are turning to a new class of software to impose order on a glut of computer-generated design documents. Product data management may breathe new life into ill-managed product life cycles.

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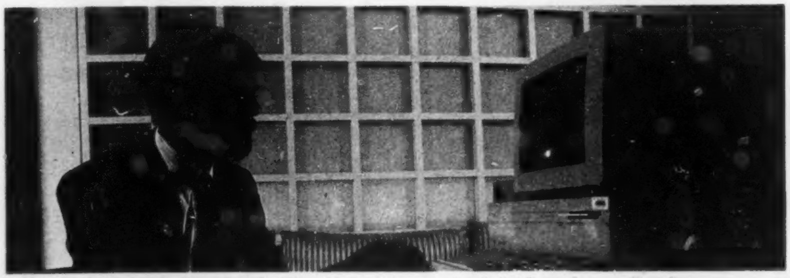
IBM Fiber Breaks Data Center Barrier 85

BY TED BUNKER A fiber optic connectivity architecture that promises greater computer room configuration flexibility topped a slate of new products unveiled by IBM in September.

ESCON is IBM's latest architecture based on fiber optic channels.

INTERNATIONAL

Special supplement, no included in all issues. 80-4



Northern Telecom's Strudwick: The Mac is his principal platform for application development, page 75.

DATAMATION'S

PRODUCT GUIDE

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SOFTWARE'S BIG 50

Recession? Not yet for software; sales are booming. As IS managers look to cut costs and boost efficiency, they're turning in droves to software vendors with solutions for sale.

BY LEILA DAVIS

Revenues earned in 1989 by the nation's top 50 independent software vendors soared by 46% over the previous year, according to the first annual DATAMATION report on the 50 largest U.S. software companies. Driving that growth, say top executives at leading vendors, is increasing demand for faster, more cost-efficient software solutions at corporate IS shops.

To develop our first ranking of the 50 largest U.S. software companies, DATAMATION researchers surveyed the software leaders in our annual DATAMATION 100 report to obtain most recent data on each company's revenue, income and research and development (R&D) spending in calendar years 1989 and 1988.

The rate of revenue growth will remain strong this year for those companies that can continue to successfully give users what they need: straight-ahead solutions to their corporate information problems at lower price/performance ratios and without overly optimistic promises. Information systems managers are under pressure from their own top management to produce fast, workable solutions for enterprisewide computer networks. Since IS staff budgets are not growing and immediate solutions are in demand, customers will rely heavily on those software vendors that can deliver.

"People are tired of waiting," says Michael King, president and chief executive officer of Software AG of North America, the Reston, Va.-based seventh largest independent software company. "In the 1990s, the CIO will be pressed to deliver on business solutions. Customers are generally looking for a steady hand in software—steady and safe—not a company following every fad. Basically, people are looking for products that work."

King says the software industry must offer a "clear strategy and focus," as well as a diversity of products to encompass today's heterogeneous computing environment. "We have to move from an entrepre-

Software's BIG 50

1989 Rank	Company	1989 Total Rev.	% Increase From 1988	1989 R&D Spending	% Increas[illegible] From 19[illegible]	[illegible]9 R&D [illegible]v. %	Net Income	Employees
1	Computer Associates International Inc.	1,290.0	39.5%	167.8	39.5%	[illegible].0%	133.2	7,000
2	Microsoft Corp.	973.0	35.0%	95.7	27.6%	9.8%	170.5	5,635
3	Oracle Corp.	753.8	90.9%	73.0	104.5%	9.7%	97.7	6,400
4	Lotus Development Corp.	556.0	18.7%	94.3	12.5%	17.0%	68.0	3,100
5	Dun &Bradstreet Software Services Inc.	450.0	125.0%	90.0	125.0%	20.0%	N/A	3,700
6	Novell Inc.	422.0	21.6%	42.8	74.0%	10.1%	48.5	2,300
7	Software AG*	294.9	24.5%	59.0	24.5%	20.0%	N/A	3,300
8	McDonnell Douglas Systems Integration Co.	290.0	9.8%	27.0	-6.9%	9.3%	N/A	2,000
9	WordPerfect Corp.*	281.4	57.2%	28.1	N/A	10.0%	N/A	2,219
10	Bolt, Beranek and Newman Inc.	276.8	-9.6%	28.1	N/A	10.2%	N/A	2,867
11	Ashton-Tate Corp.	265.3	-13.7%	68.7	29.9%	25.9%	-28.6	1,450
12	Pansophic Systems Inc.	232.0	28.0%	18.6	89.8%	8.0%	26.5	1,900
13	American Management Systems Inc.	225.3	5.6%	14.8	5.0%	6.6%	7.4	2,800
14	SAS Institute Inc.*	205.6	20.7%	92.3	0.0%	44.9%	N/A	2,170
15	Ask Computer Systems Inc.	190.0	13.1%	N/A	N/A	N/A	9.2	943
16	Sterling Software Inc.	184.4	10.2%	13.4	1.5%	7.3%	7.9	1,800
17	Autodesk Inc.	178.6	52.3%	21.3	35.4%	11.9%	46.4	905
18	Cincom Systems Inc.*	171.1	2.3%	N/A	N/A	N/A	N/A	1,400
19	Information Builders Inc.*	160.0	16.0%	19.2	N/A	12.0%	N/A	1,400
20	Informix Software Inc.	145.0	45.0%	N/A	N/A	N/A	6.4	1,200
21	Legent Corp.	142.8	28.9%	31.5	23.5%	22.1%	31.3	1,000
22	Information Resources Inc.	136.4	16.6%	N/A	N/A	N/A	-12.0	1,577
23	Ingres Corp.**	130.7	45.0%	N/A	N/A	N/A	6.2	1,200
24	Candle Corp.*	128.1	27.7%	38.1	12.7%	29.7%	N/A	970
25	Compuware Corp.*	123.0	23.0%	N/A	N/A	N/A	19.5	1,481
26	Adobe Systems Inc.	121.4	45.4%	13.4	86.1%	11.0%	33.7	450
27	Software Publishing Corp.	109.0	35.0%	4.5	N/A	4.1%	18.6	476
28	Borland International Inc.*	104.4	11.3%	13.8	0.7%	13.2%	9.7	583
29	Cognos Inc.	97.2	20.4%	15.3	35.4%	15.7%	-13.5	1,047
30	System Software Associates Inc.	94.9	54.3%	5.8	61.1%	6.1%	11.1	400
31	Comshare Inc.	94.6	14.3%	14.1	10.2%	14.9%	6.3	960
32	Interleaf Inc.	92.0	22.8%	14.8	52.6%	16.1%	-15.6	785
33	Goal Systems International Inc.	86.6	42.0%	9.6	39.1%	11.1%	10.5	780
34	American Software Inc.	86.3	34.2%	6.5	30.0%	7.5%	17.2	709
35	Metier Management Systems Inc.	86.3	-9.2%	9.7	24.4%	11.2%	2.2	650
36	On-Line Software International Inc.	86.0	4.9%	7.0	-16.7%	8.1%	4.2	650
37	The Santa Cruz Operation Inc.*	83.0	36.1%	12.0	50.0%	14.5%	N/A	1,200
38	BMC Software Inc.	82.0	51.9%	20.0	33.3%	24.4%	18.0	424
39	Boole & Babbage Inc.	78.9	28.5%	14.0	16.7%	17.7%	5.4	650
40	Systems Center Inc.	77.0	30.5%	11.4	37.3%	14.8%	12.0	800
41	Symantec Corp.	71.7	41.7%	9.6	37.1%	13.4%	8.4	404
42	Softlab Inc. *§	70.5	16.0%	16.1	N/A	23.0%	11.8	500
43	Micro Focus Inc.	60.5	56.7%	8.5	14.9%	14.0%	8.1	175
44	Attachmate Corp.*	56.4	86.6%	N/A	N/A	N/A	N/A	325
45	Software Engineering of America*	51.0	27.2%	N/A	N/A	N/A	N/A	200
46	KnowledgeWare Inc.	50.1	179.9%	6.9	76.9%	13.8%	8.7	555
47	Integral Systems	49.0	32.4%	12.0	33.3%	24.5%	1.0	376
48	MacNeal-Schwendler Corp.	45.0	12.8%	8.6	22.9%	19.1%	9.8	306
49	Wordstar International Inc.¶	43.2	1.0%	5.3	3.9%	12.3%	N/A	260
50	Cadre Technologies Inc.*	42.0	20.0%	N/A	N/A	N/A	N/A	330
	Total	10,125.2	31.3%					

NOTES:

Revenue, R&D and net income figures are in millions of dollars.

Aldus Corp. is excluded due to a restatement of financial data not available at press time.

* Privately held

**Ask Computer Systems proposed to purchase Ingres in mid-September.

§Based on fiscal year ending September 30, 1989. Company declined to provide calendar year data.

¶Based on fiscal year ending August 31, 1989. Company declined to provide calendar year data.

neurial to a conventional business management approach without losing our flair," he says.

Some software executives think it's time for vendors to consolidate all the trendy technologies of the 1980s—imaging, graphical interfaces, artificial intelligence, speech recognition, compact discs and more—into practical multimedia systems residing on enterprisewide networks. The single thread connecting the implementation of these new technologies, according to Robert Tasker, vice president of software research at International Data Corp. (IDC), based in Framingham, Mass., is the need for IS to process data more efficiently and at a lower cost.

The ongoing frenzy of mergers and acquisitions (M&A) in the software industry is being used by larger ISVs as a way to try to offer a complete package of products. This falls under the theory that it is easier to acquire new technology than to develop it.

Some of the leaders in M&A include top-rated Computer Associates International Inc., fifth-ranked Dun & Bradstreet Software Services Inc. and No. 21 Legent Corp. Last year, fourth-ranked Lotus Development Corp. tried to marry No. 6 Novell Inc. but was left standing at the altar.

Robert Cook, chief executive officer of Systems Center Inc. of Reston, Va., ranked No. 40, blames the "fixation of the North American financial community on quarterly earnings" for the current acquisitions climate.

"It is difficult to invest in R&D when there is so much pressure to show quarterly gains. So companies turn to acquisition," says Cook, whose firm earlier this year acquired Software Developments International Pty. Ltd., the Australian developer of the NetMaster network management system.

Spending on research and development, as a percentage of gross revenue, barely moved at all in the software industry. Nearly half of the ISVs continue to coast along at or below the standard formula for R&D spending of 10 to 12% of gross revenues, but a sizable number are above that level, according to IDC's Tasker.

Of course, some increases in R&D spending inevitably come from efforts by acquiring firms to integrate their new, disparate product lines. "A lot of R&D money is spent—not on new products but on getting acquired products to work together. That's not moving forward," says Software AG's King.

In communications, "R&D spending is still relatively high because we have a long way to go to reach maturity," says Darrell Miller, executive vice president of Provo, Utah-based Novell. "Generally as an industry matures, resources are shifted from new development to service and support. But communications is still a young, growing, maturing industry. We are still very immature as far as the tech-

SYSTEMS CENTER'S COOK: Bigger isn't necessarily better.

What would it take to outperform DASDMON?

CANDLE'S CHERNICK: Merging companies may wind up supporting competing products.

nology goes."

Novell spent a healthy $42.8 million on R&D last year, an increase of 74%. But because sales were also strong last year, that only worked out to about 10% of gross revenue. Last year's aborted merger with Lotus had no effect on R&D spending plans for 1990.

Most software executives expect the pace of merger and acquisitions activity to remain strong in the industry for some time. And Tasker sees a new growth area for M&A developing. "Hardware companies realize that if they are just selling hardware, they will be out of business by 1995," says Tasker. "Those that haven't been particularly into software in the past are shopping hard for software companies right now."

The Barbell Theory

Tasker also believes the industry will eventually come to resemble a barbell shape, with a large group of very big companies at one end, a few struggling midsized companies in the middle and a large and ever-replenishing number of small start-ups at the other end. Those few remaining midsized companies will be prime targets for mergers and acquisitions.

But not all software executives agree that M&A is the most efficient way to obtain new products. The acquired technologies still must be integrated into existing product lines, often at considerable expense.

"Bigger isn't necessarily better," says Cook. "If the products fit into your company's strategic direction, it can be better to acquire. But, if not, you're just creating software junkyards."

According to Los Angeles-based Candle Corp.'s chief executive officer, Aubrey Chernick, "A company has to have either an acquisition strategy to buy innovation or an R&D strategy to develop products in house." But those companies that chose the M&A strategy may wind up supporting several competing products, he notes.

Management at Microsoft Corp., the nation's second-largest software firm, takes a similar view of the recent merger mania. "Being large is not a guarantee of success—you have to be competitive and agile. In software, the size of a company doesn't create a significantly better cost structure. The complexity of integrating and [supporting] overlapping products is why we have been relatively inactive in mergers and acquisitions," says Microsoft president Michael Hallman. "Products must work well and work well together as we move into a more graphical environment."

The Open Road

Hallman also says that technology produced and

developed through mergers and acquisitions must maintain an open architecture to meet customers' needs. "We believe in standards and openness. If a hardware company acquires a software company, that can be good as long as they are not creating a more proprietary environment."

Joseph Agro, executive vice president at Software AG, cites openness as "a condition of survival" in the software industry. "We must help customers to solve problems, and openness is the way to do that--it is an open, heterogeneous world."

"No one can supply every part of the solution. That's why openness is important," adds King of Software AG. "Client/server computing is important. Development productivity tools are important, like CASE tools, fourth-generation languages, imaging, text storage and retrieval. The trick is to get at it all."

Microsoft's Hallman sees system hardware becoming a generic configuration to which the buyer will add multimedia hardware and software to create a system specialized to his or her needs, but open to the network. "In general, client/server applications and desktop computing will be very hot, with rich graphical interfaces to improve ease of use," he says. "We will finally get technology to adapt to the way people work, rather than people adapting to the way technology works."

Hallman expects to see continued development of voice and handwriting interfaces "that will be immensely appealing to the user and have enormous potential. Voice should be just another piece of data," he says.

With all these new additions to the network, communications software vendors Novell and Systems Center see network management, including artificial intelligence capabilities, as a crucial area of software development for the coming decade.

"In terms of technology, we [in networking] are still working on the basic block and tackle. But everything is synergistic—the new RISC [reduced instruction set computing] processors speed the ability for more sophisticated applications with high-resolution graphics, which speeds the need to move more data, so we have to have faster network pipes," says Novell's Miller.

According to Cook at Systems Center, "the biggest trend driving the software market is network management and the need for connectivity between diverse hardware platforms. There is a lot of T1, T3, voice/data integration, LAN growth, etc. Someone has to tie them all together for the customer.

"And what is driving the customer—the IS manger," says Cook, "is the mass of information that he can't get his arms around. Software will be the way to achieve that goal." ▭

MICROSOFT'S HALLMAN: We believe in standards and openness.

SOFTWARE AG'S KING: People are looking for products that work.

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Making Pan-European Retailing Work

European retailers are gearing up for 1993's cross-border trading by sharing new technology designed to improve distribution and cut costs. Customers are reaping the benefits. But some retailers are battling critical problems.

BY STEVEN SONSINO

IMPACT '93

No one would have believed, in the last months of the 1980s, that the integration of the East and West German currencies would effectively be complete less than a year after the Berlin Wall was first breached. The integration of the two economies makes it clear that, although problematic, it will be possible for retailers to trade across Europe when the European Community's internal barriers to trade are removed at the end of 1992. Those with foresight are planning new strategies now to take advantage of the changes coming in 1993. Retailers are looking to fine-tune distribution, ordering and cost cutting, and so they are looking to the latest technology, from bar-code scanners to systems for electronic data interchange (EDI).

Implementing continental retail operations will not be easy. The willingness of retail management to introduce and manage information technology will be critical to success in the 1990s. One plan is the formation of cross-border consortia aimed at cost cutting through economies of scale. Perhaps the most significant of these groups is the recently formed European Retail Alliance, comprising Argyll, which operates the British Safeway stores, the Dutch Ahold group of companies and the French corporation, Casino.

Interest in the alliance's aims has spread so much that it now forms the core of Associated Marketing Services—a group of nine supermarkets that also includes Dansk Supermarked, Sweden's ICA, Finland's Kesko, Italy's La Rinascente and Spain's Mercadona. The thread that holds these diverse retailers together is a heavy reliance on store-brand goods. The group plans to share significant techniques such as EDI and direct product profitability (DPP).

Calculating the DPP is a complex process that involves determining the gross profit margin of a product and then adjusting that margin to allow for discounts. Subtracting the cost of storage and distribution yields a reasonable guide to how much profit each of a supermarket's thousands of product lines generates. The DPP is valuable for measuring how each product fares.

In Europe, Ahold and Casino are the chief proponents of employing the DPP to calculate profit margins. Through these companies, national trade associations such as the Institute Francais du Merchandising (IFM) and the Institut fur Selbstbedienung have developed industrywide models for the DPP. Based on the IFM model, Casino developed its own PC software to calculate DPP. The system has proven so successful that Casino plans to upgrade it to run on IBM mainframes.

Retailers Sold On EDI

Perhaps the technology with the greatest potential for European retailers is EDI, the latest form of paperless trading, says Philip Coathup, director of EDI business development with Britain's Istel, now part of AT&T.

One of the most advanced EDI systems in Europe is Tradanet, which is based on

EUROPEAN CONSUMERS carry debit cards these days, as retailers implement electronic funds transfer at point of sale. (EFTPOS)

Retailers Buy Into Scanning Equipment

The number of stores that use European Article Numbering scanning equipment is growing rapidly.

	1981	1983	1985	1988	1989
Austria	0	9	56	304	1,665
Belgium	0	12	115	356	863
Denmark	0	0	14	416	1,061
Finland	0	3	9	325	1,310
France	2	37	420	2,300	4,648
West Germany	23	69	290	1,544	3,434
Greece	0	0	0	0	0
Ireland	N/A	N/A	N/A	14	14
Italy	9	13	20	618	3,600
Luxembourg	N/A	N/A	N/A	18	18
The Netherlands	1	36	134	580	800
Norway	1	1	33	742	1,136
Portugal	0	0	0	81	220
Spain	0	2	36	422	1,603
Sweden	N/A	N/A	131	710	1,725
Switzerland	N/A	N/A	N/A	91	575
United Kingdom	7	42	160	1,152	3,999

Source: European Article Numbering Association

the U.K. Tradacom standards put forth by the European Article Numbering Association (EAN). Standardized article numbering, or symbol marking, has been key to the success of bar-code scanning in Europe. This U.K.-based association and its 35 affiliate organizations across the world have encouraged the acceptance of a standard set of codes for product marking. Most food suppliers, along with many in the nonfood sectors, such as do-it-yourself home improvement chains, have adopted the EAN's symbol-marking system.

Another advanced EDI system is the Dutch Transnet system, which is based closely on U.K. standards. In Germany, the SEDAS system is well on its way to acceptance as the main EDI medium; it also forms the core of the Austrian Ecodex network. Other European systems in evidence include the Belgian ICOM network and the Groupe Bull SA system, Allegro, devised with France's article numbering association, Gencod.

The EAN is particularly concerned with developing standard EDI links across the continent. Thus far, more than $6.5 million has been devoted to this task through the trade and electronic data interchange system, TEDIS.

Employing EDI Now

Devising cross-border systems is all very well, but many users want access to the savings and benefits of EDI now, not in 1993. These users should devise a traditional business strategy before embarking on a course that involves EDI. "Users should decide whether they want to use EDI to save time or money," says Istel's Coathup. "Then they should make sure their computer systems are up to it and should find someone who's already doing it."

☐ THE MAIN PROBLEM IS GETTING BUSINESSES TO TALK TO EACH OTHER.

One firm employing EDI now is Texas Homecare, one of Britain's largest do-it-yourself chains. Based in Wellingborough, in Northamptonshire, Texas Homecare uses EDI strategies and technology to help operate more than 280 stores across Britain. EDI streamlines the handling of the 100,000 or more invoices the company receives every week.

Andrew Coote, former merchandising manager for Texas Homecare, suggests that the interesting side of EDI is the way it can be molded to become the core of an entire IS strategy. Texas Homecare decided that straight EDI—between supplier and retailer—was not enough, and has added extra functions to its EDI links, such as sales analysis and forecasting. In order to do this, the firm relies on IBM equipment. Other members of the do-it-yourself community have criticized the company's plans, largely complaining about the firm's choice of IBM's Business Network Service (BNS) as a carrier, rather than INS's Tradanet, which is used by most other suppliers. This choice of systems can cause problems for vendors that supply retailers using the different networks. Whereas Tradanet is machine independent, BNS is only accessible through IBM equipment, requiring Texas Homecare suppliers, for instance, to use IBM gear in addition to their already installed computer systems.

In Texas Homecare's defense, Coote explains that "the problem is that Tradanet was not going to go beyond the batch EDI approach." BNS, however, can support the extra functions that Texas Homecare wanted and support links with international suppliers. The company's systems director, Andrew Kinnell, says: "From a startup of about 18 months ago, we've got some 180 suppliers signed up. We have to try to explain that we are not selling an alternative to Tradanet. Rather, we are giving a plus service."

The heart of Texas Homecare's EDI system is a package from U.S. software house PR Johnson, running on an IBM 3090 mainframe at the company's Wellingborough office. On top of the main system, Kinnell is investigating additional statistics packages to help the company analyze current sales and even predict future demand. One package the company is looking at closely is IBM's Inform, which simply tags onto the merchandising system.

Impatient Wait For Standards

One of the most significant problems facing European retailers wanting to implement integrated distribution strategies, especially across country lines, is the lack of technology standards.

Keith Marshall, principal of Her Majesty's Customs Directorate Division D7, is responsible for the technology used by Her Majesty's Customs and Excise in Britain. "Europe is waiting for us to set [standards]," he says. At the very basic level, there are communications protocols to consider: IBM's Network Job Entry is popular, allowing multiple hosts to share job queues and system spools, while terminals using X3780 protocols are more common than many appreciate, says Marshall.

Customs and Excise has undertaken a number of projects to ease the introduction of paperless trading, before 1993 if possible. In August 1989 the department introduced the Fast Lane Clearance System to move goods through customs on the basis of electronic declarations. Until recently, Customs and Excise required 35 forms for goods crossing international borders. The directorate has now shrunk this requirement to only one form, and even this will disappear in 1992, freeing import/export computer systems for more important functions.

Also in the wings is the Customs Handling of Import and Freight system, or Chief, which should replace all the functions of Customs and Excise's on-line inquiry system, called DEPS, a mainframe-based system that supports multiple terminals. Chief will enable the department to share data between all U.K. ports and airports via value-added networks. DEPS already handles a great deal of the import and export data, but there is much data duplication in the DEPS database.

What all this development will achieve for retailers is an improvement in the volume and quality of the data available to them.

Fruits Of Automation

One of the most advanced retailers of the 1990s will be one of Britain's largest supermarket operators, Sainsbury's, which began an ambitious program of information technology development 10 years ago and is now seeing the fruits of its early work. The London-based retailer was one of the first in Britain to establish a central distribution network. A fleet of 750 trucks now makes daily deliveries from its own or contracted warehouses. The results? Every week, more than 7 million customers purchase products from among the company's 10,000 product lines, giving it 11% of the national food and drink sales, with revenues of almost £5 billion ($9.4 billion). The company's profits are growing at 20% yearly.

> ☐ **SAINSBURY'S INSTALLED SCANNING CHECKOUTS IN ALMOST ALL OF ITS SUPERMARKETS.**

Handling a central distribution system without major IT support would have been impossible, so the company installed an International Computers Ltd. (ICL) minicomputer in every store to support the daily ordering process. Orders were passed via the data communications network to a central mainframe that processed the orders.

Sainsbury's has also installed scanning checkouts in almost all of its supermarkets at a cost of £65 million ($123 million). The scanners help customers check out more quickly and remove the need for costly and time-consuming price-labeling operations, says Alan Jacobs, the company's director of data processing. The new systems have also enabled Sainsbury's to improve store ordering and get a better idea of what customers want. ▭

Steven Sonsino is a London-based writer who specializes in information systems and scientific topics.

Payment Systems Smarten Up

European wallets are getting thinner these days—not due to lack of money, but because many customers no longer need to carry cash. Debit cards are rapidly gaining acceptance and are considered a major retailing advance. Electronic funds transfer at point of sale (EFTPOS) systems improve customer service, speeding checkout lines and providing convenience.

Sainsbury's, one of Britain's largest supermarket chains, introduced EFTPOS terminals in 40 major stores in time for the 1988 Christmas peak. The systems proved popular with customers and management alike: now more than 200 stores are fitted with EFTPOS.

When customers use debit cards at EFTPOS store terminals, data from the card are transmitted to an independent host. The host checks that the card has not been stolen and then authorizes the transaction. This process is usually conducted over standard telephone lines using either an X.25 network or Cardaway, British Telecommunication Ltd.'s electronic funds transfer network.

However, despite Europe's interest in EFTPOS, development on the Continent lags behind that of the Far East. There, government, banks and retailers are putting significant resources into EFTPOS. The most successful Far-Eastern project is running in Singapore, where two influential banks form the core of a five-bank consortium that in 1986 underwrote the country's EFTPOS network, the Network for Electronic Transfers Singapore (Nets). In its first eight months, transactions worth S$25 million ($9.3 million) passed through the system.

In comparison, U.K. banks have been slow to take interest, although tests have been under way since the early 1980s. Clydesdale Bank ran the first live on-line system, Counterplus, in 1982. The most widespread system today is Barclaycard's PDQ (Process Data Quickly), formerly called Darts. There are more than 7,000 PDQ terminals now in place, and this number should double by the end of this year.

In 1985, the EFTPOS U.K. organization incorporated to establish common rules for debit card transactions in Britain. Now EFTPOS U.K. is a clearing company within Britain's Association of Payment Clearing Services. Successful trials, running 2,000 terminals, have been carried out in Edinburgh, Leeds and Southampton. The linchpin of EFTPOS U.K.'s plans is customer identification by passwords, or personal identification numbers (PINs).

However, some retailers take a dim view of this identification method. Robert Woodman, director of Burton Group PLC and chairman of the Retail Consortium's payment systems policy unit, says: "We have reservations about what EFTPOS U.K. is doing, especially with reference to its concentration on PIN verification."

Most systems do offer an alternative to identification by number, one that the British are loathe to part with: the signature. All Woodman asks is that the retailers be left with the choice. "The retailer clearly has to be able to accept a variety of payment systems, but the major form of authentication for credit cards, cheque cards, even the new Switch card [a debit card] is a signature. PIN, we believe, will be very much a minority activity."

J. SAINSBURY'S, a leading U.K-based supermarket chain, is one of the most technologically advanced retailers in the U.K.

AT&T Computer Systems thinks it has met that challenge with its StarGROUP UNIX networking products. With the introduction of its StarGROUP Server for Macintosh software, the company is one of the first major vendors to offer support for DOS, UNIX, OS/2 and Macintosh systems in one network operating system.

StarGROUP Server for Macintosh software is designed to operate on either AT&T's 80386 or 80486 microprocessor-based servers running the company's UNIX System V release 4.0 operating system. The Macintosh software runs under AT&T's StarGROUP LAN Manager Server, a local area network (LAN) operating system that is actually a proprietary UNIX version of Microsoft's LAN Manager. A version of the software to support eight users is priced at $795; an unlimited user license is priced at $1,295. The product, which is now in beta test, will be available in January.

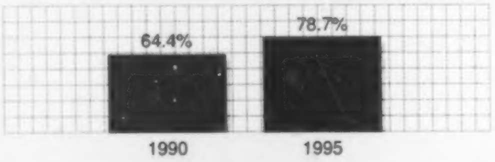
With StarGROUP Server for Macintosh and an AppleTalk router, either stand-alone or networked Macintosh users can be connected to an AT&T server to share files and printers with DOS-, OS/2- and UNIX-based computers. Each Macintosh communicates with the server through AppleShare software that is shipped by Apple with each Macintosh. The Macs are tied to the server through an Ethernet network.

Users on a StarGROUP network can transparently share files and printers; files created by one user can be accessed and modified by another. For example, a data file created by a Macintosh client can be accessed and modified by an OS/2, DOS or UNIX client, and vice versa. A database application and its files can be accessed by all four client operating systems without modification, and all users retain their familiar interfaces.

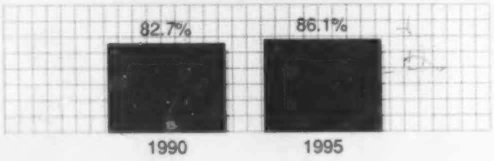
IS Executives Want Network Flexibility

Network connectivity options, combined with compatibility with current hardware, are top concerns when purchasing PC equipment.

PERCENTAGE THAT CONSIDER NETWORKING VERY IMPORTANT



PERCENTAGE THAT CONSIDER COMPATIBILITY WITH INSTALLED SYSTEMS VERY IMPORTANT



Based on a survey of more than 200 IS executives in *Fortune* 1,000 companies.

Source: Business Research Group

DATAMATION **December 1, 1990**

IN FOCUS

StarGROUP Server

AT&T Computer Systems
Morristown, N.J.
Price: $795 (8 users)
$1295 (unlimited license)
Circle No. 500

System Requirements:
- UNIX System V release 4.0 operating system
- AT&T's StarGROUP LAN Manager Server software
- An AT&T 80386 or 80486 microprocessor-based server
- An AppleTalk router

Key Benefits For IS:
- Easy setup
- Only one backup needed for all network files
- Lets users keep familiar interfaces

"The product was designed to satisfy the demands of academic, business and government Macintosh users for connection to a common server," says Mike Sloan, product manager for StarGROUP Server for Macintosh. According to Sloan, software servers for other systems, such as Novell networks, will be added to the StarGROUP product line in the future. Recently, AT&T announced a software server for IBM local area networks. The product ties PCs networked with IBM PC LAN, LAN Server and LAN Requester software to an AT&T network.

So far, AT&T's moves have garnered praise from both analysts and users. Says Tom Wood, a market analyst with the Business Research Group in Newton, Mass., a Cahners Publishing company: "By allowing Macintosh users to access data on a UNIX server just as if it were a Macintosh server, AT&T is moving in the right direction and has introduced a pretty impressive product. Although there are other LAN servers that interface with the Macintosh, such as Digital Equipment's DEC LanWORKs, the AT&T product is the only Intel-based UNIX server currently available [for the Macintosh]."

Wood says the AT&T software is especially relevant to businesses now that Apple has introduced a line of lower cost, more powerful Macs to compete with IBM in the corporate desktop market.

Bernard Hecker, assistant director of computing at Trinity College in Hartford, Conn., has been beta testing AT&T's Mac software for several months. Hecker administers three large AppleTalk networks linked to an AT&T server shared by PC and workstation users. "This is one impressive server for PCs, Macs and UNIX clients," he says. "I don't have a huge technical staff, and the server saves us time because there is only one system to back up."

Trinity runs database, word-processing and graphical applications off the server. Hecker says the AT&T system has done exactly what the school wanted it to do, with no additional software to write and very little downtime. Hecker says he will be first in line for the final version of the software. "We will start by buying the unlimited license for one server and then add more hardware depending on future traffic on the network," he says. "I've made a commitment to do Macintosh networking via AT&T's Mac server." ▭

MARKET INSIGHTS

AN ANALYSIS OF ECONOMIC TRENDS

Indicator Points To IS Upturn

BY MADELINE FRANCHI
Cahners Economics

The DATAMATION Information Systems Performance Indicator is continuing its downward slide. The indicator fell to 100.41 in July from a revised 100.75 in June and will most likely bottom out this month at a low for the year of 99.4. But the end is in sight; we expect the indicator to slowly rise early next year, reaching a peak by the third or fourth quarter, with a total increase of 5% for all of 1991.

Hours worked in the computer industry fell by nearly 2% in the most recent month, while the number of persons employed in the sector fell by just under 1%. Changes in the number of average hours worked generally provides an early hint of the direction overall employment will take. That's because manufacturers generally increase hours worked—including overtime—during the start of an economic upturn, then add employees when growth looks persistent; conversely, employers first decrease hours worked before laying off workers during an economic slowdown.

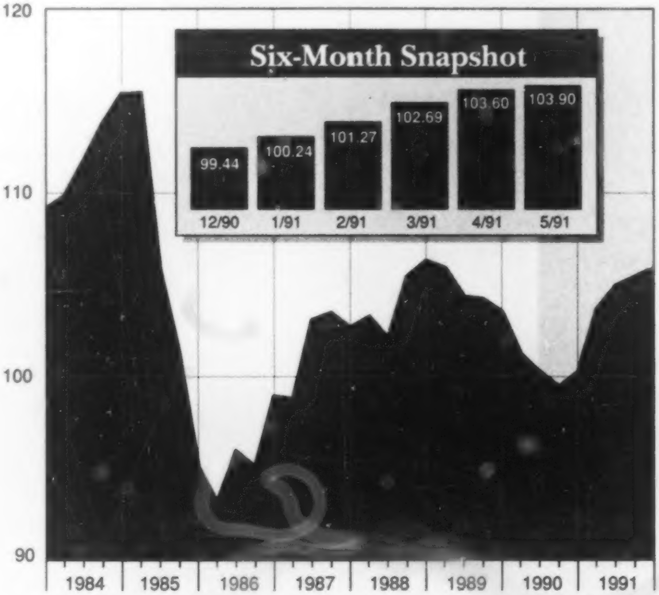
Although some other measures are still weak, signs of a coming recovery for the IS sector are becoming evident in data on new orders. In July, new orders for computers, peripherals and communications equipment totaled $10.4 billion—up 6.7% from June and up 11.5% from July 1989. ▭

Methodology

The DATAMATION Information Systems Performance Indicator tracks the economic health of the IS industry. Cahners Economics developed this indicator, which is based on weighted moving growth rates for five statistics: (1) IS inventory, (2) new IS orders, (3) average weekly hours of computer industry employees, (4) Standard and Poor's Computer Systems Stock Price Index and (5) contracts and orders for plant and equipment. For more information on Cahners Economics's forecasting services, including seminars, newsletters and database diskettes, contact Dan Buchan at (617)-630-2105, by fax at (617)-630-2100, or write to Cahners Economics, 275 Washington Street, Newton, MA 02158.

The IS Performance Indicator

Things are finally starting to look up again for the IS industry.



*Shaded area denotes forecast

Source: Cahners Economics

	July 1990	June 1990	% Change 6/90-7/90	July 1989	% Change 1989/1990
■ **Information-Processing Equipment**					
Shipments (SA, $ millions)	9,644	10,022	-3.8	9,320	3.5
New Orders (SA, $ millions)	10,399	9,742	6.7	9,329	11.5
Unfilled Orders (SA, $ millions)	29,061	28,306	2.7	27,678	5.0
Inventory (SA, $ millions)	21,212	20,888	1.6	22,074	-3.9
■ **Computer Production Workers**					
Employment (NSA, thousands)	274.4	276.7	-0.8	293.6	-6.5
Average Weekly Hours (monthly avg.)	41.2	42.0	-1.9	41.4	-0.5
■ **Stock Index**					
S&P's Computer Systems Stock Price Index	193.65	196.31	-1.4	190.33	1.7
■ **Contracts & Orders**					
New Plant & Equipment (SA, $ billions)	43.59	39.96	9.1	45.99	-5.2

SA= seasonally adjusted;
NSA= nonseasonally adjusted

Sources: U.S. Commerce Dept. and Standard & Poor's;
Forecasts: Cahners Economics

MARKET INSIGHTS

A SURVEY OF TECHNOLOGY TRENDS

Voice-Data Applications On The Rise

BY WARREN CHILDS
Business Research Group

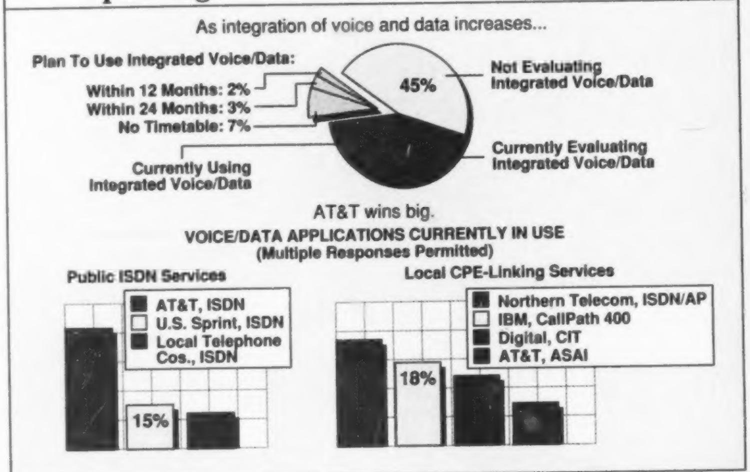
The latest survey of the DATAMATION High Technology Panel shows growing interest in integrated voice and data applications. Almost one panel member in three, 29%, has implemented some form of integrated voice-data software or is planning to do so.

Users of voice-data applications face two basic decisions when implementing this technology. First, they must decide which vendor to use for the Integrated Services Digital Network (ISDN) to connect their off-site users. Second, they must choose a particular vendor's technology for software that links the local computer equipment—the customer premises equipment (CPE)-linking software.

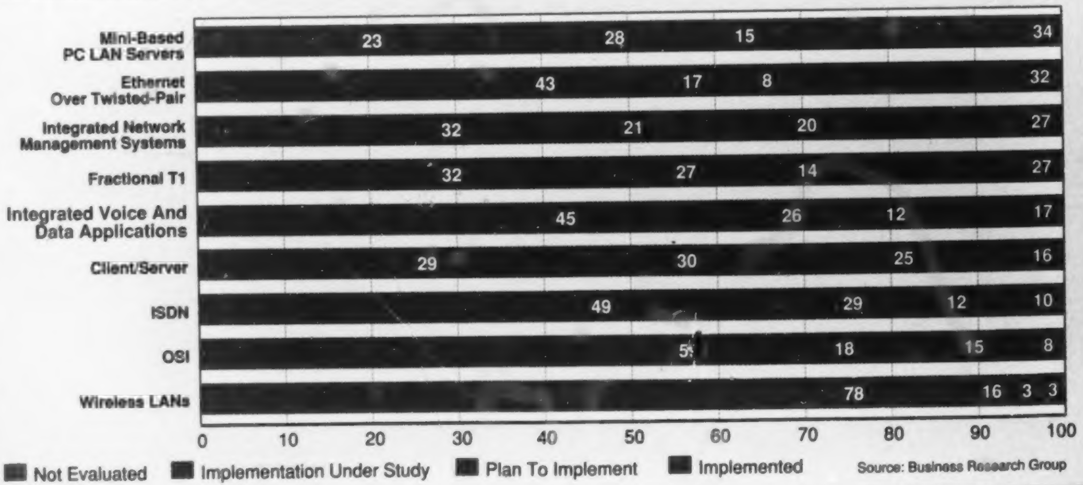
For voice and data integration applications, AT&T is by far the most popular vendor of public telephone network ISDN services, picked by 41% of the DATAMATION High Technology Panel. Another 15% picked U.S. Sprint Communications Co., and 12% say, they use local phone companies for these services.

The choices are somewhat wider when it comes to vendors of local CPE-linking software. Selected by 23% of the voice-data users on our panel, Northern Telecom Inc.'s ISDN/Applications Part (ISDN/AP) is the leader with its PBX-based ISDN capabilities. But three other products—IBM's CallPath 400, with 18%; Digital Equipment Corp.'s Computer Integrated Telephony (CIT), with 15%; and AT&T's Adjunct Switch Applications Interface (ASAI), with 9%—are also strong contenders for local voice-data support software services.

Speaking Out On Voice/Data Integration



DATAMATION's Technology Implementation Index: Networks/Communications



Source: Business Research Group

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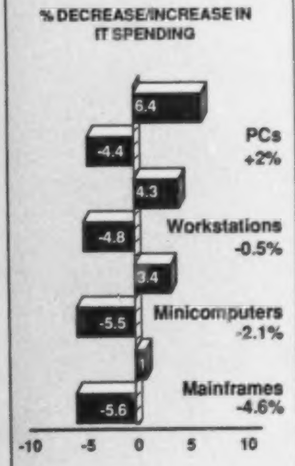
Investments in computers, networks and software are no ordinary capital outlays. That's why present products, not past economic cycles, will determine whether users will buy today or tomorrow.

Should A Recession Curb Your Computer Appetite?

History is a very poor teacher of economic lessons when the subject is whether a recession might, or should, affect spending on information technology. The data from the 1973–1975 and the 1980–1982 recessions that economists and analysts would normally sift through to predict whether users are going to cut their IT budgets in a recession are meaningless. The continual improvements in system price and performance made during the past 20 years render statistics like Federal Reserve production values—the stuff of economic models in other industries—useless for recessionary analysis.

Are PCs Recession Proof?

How a U.S. recession may affect 1991 spending plans.



Source: DATAMATION/Cowen & Co.

With the past bankrupt of information on whether to spend more or less in a recession, users are forced to examine the present for answers as they enter, if only psychologically, a recession in the United States and in Western Europe. They must look at how their peers are reacting to economic adversity. They must understand what competitive challenges are facing their own organizations. And they must explore what products and services are being delivered, not promised, by suppliers. On all three fronts, the message seems clear: now is not the time to retreat from investments in IT, although it is precisely the right moment to be choosy about IT.

Information systems managers tell DATAMATION that if any one platform will attract more of their dollars in a recession, it's the personal computer. That's odd if you still regard PCs as word processors purchased at the discretion of end users. The finding is understandable, however, in light of the new role that laptop and desktop systems are playing in the distributed-computing strategies of most organizations—as intra- and interorganizational computers, not simply as personal productivity tools.

At the other end of the technology spectrum, mainframe platforms are losing some of their luster in tough times—too pricey, no doubt, to completely escape the budget ax of chief financial officers.

In past recessions, companies coped by cutting work forces, postponing plant and office modernization plans and savaging research and development budgets. Today's business leaders recognize that those old bromides don't work in a global economy. They can't cut too much deeper into their employee ranks than previous layoffs have already reached. They know they can't get by on plants built in the 1950s or offices equipped in the 1970s. And they can't wish themselves out of tough markets—they have to develop new products and services to grow in those markets or create new ones. They realize that IT, if properly applied, can lift their workers to new heights and speed delivery of innovative goods to market.

The price of IT, and the ease with which it can be applied, only grows more attractive with every new major product introduction rolling out of Redmond, Wash.; Cupertino, Calif.; Armonk, N.Y.; Paris; Tokyo or any other headquarters of a supplier of significance. Fears of a recession haven't stopped Microsoft Corp. from hiring hundreds of programmers to develop new networking products, or Apple Computer Inc. from delivering low-priced Macintoshes, or IBM from reaching the Summit with its System/390, or Groupe Bull from developing a distributed architecture or any of the major Japanese companies from pushing notebook PCs to unbelievable levels of performance.

Their investments are driven by competition, challenges and, yes, even their own suppliers—not by economics. Your IT outlays should be guided by the same forces.

Tim Mead

Tim Mead, Editor-In-Chief

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112 TOTAL PAGES

DATAMATION

FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE

DECEMBER 15, 1990

Philippe Kahn, Borland's CEO, with Quattro Pro

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DECEMBER 15,
1990

DATAMATION

VOLUME 36
NUMBER 24

FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE

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Borland's Spreadsheet Contender 34

BY JOHN McMULLEN Nothing has ever come close to unseating Lotus 1-2-3 as the world's most popular spreadsheet package. But Borland's feature-packed Quattro Pro 2.0 stands a fighting chance to dethrone the king.

Cover photo by David Toerge/Black Star

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BY MIKE RICCIUTI
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NaviGate takes users directly to system slowdowns, says Landmark's Jim Foxworthy.

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One for all and all for one UNIX, page 59

Reduced R&D spending has some HP 3000 users feeling abandoned, page 69

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Timeplex Girds For Data Deluge

Timeplex sees LANs, video and data traffic occupying more network real estate than voice in the '90s. To service that traffic, Timeplex says it will become a full-line communications equipment vendor.

BY KURT ROTHSCHILD

The era of voice dominance on the worldwide communications network is coming to a close, according to projections by Timeplex Inc. of Woodcliff Lake, N.J., based on a survey of 200 of its customers.

"While voice accounts for 50% of the current traffic demand, it is expected to drop to 40% by the '93–'95 time period as transmission of data and graphics become more important segments of network traffic," says Dewaine Osman, president of the T1 multiplexer vendor.

That kind of growth in data traffic is one of the reasons that the Unisys Corp. subsidiary announced this September that it would take over the assets of Irvine, Calif.-based Doelz Inc. and market that company's cell relay technology along with its own frame relay technology. The move is part of Timeplex's plan to transform itself from a leading supplier of T1 multiplexers to a broadline vendor of local and wide area network communications systems. As part of meeting this goal, Timeplex also introduced a new ISDN Gateway Server (IGS) and announced enhancements to its Time/View 2000 network management system.

Referring to the company's growing array of products, Osman zeros in on frame and cell relay technology and fast packet switching as vital to meeting emerging communications needs. "Faster transmission speed—preferably at lower cost—as well as simpler network management systems will be required," according to Osman, to accommodate the expected overall increase in total traffic.

New Look For Timeplex

Changes in data transmission needs will force equipment vendors to modify their marketing plans, according to Timeplex. "To be a major player in networking in the '90s, you must offer a well-rounded technology," said James J. Fiedler, executive vice president. "T1 multiplexer-only companies are going to be the dinosaurs of the '90s."

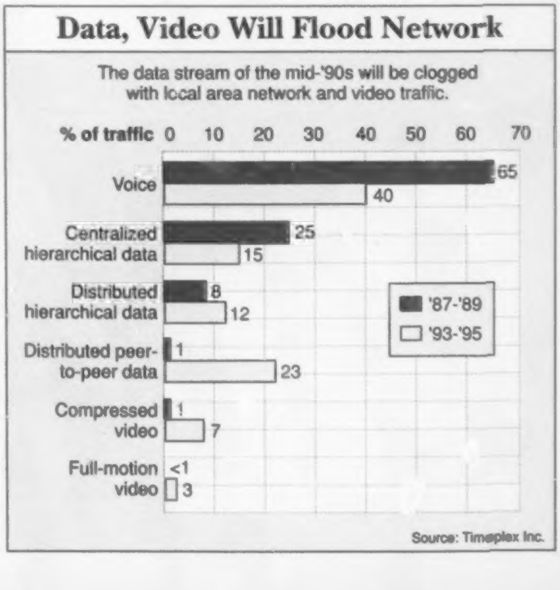
Timeplex is currently considered to be the leader of the T1 multiplexer market, according to Rick Malone, principal of Vertical Systems Group, a Dedham, Mass., consulting firm. According to Vertical Systems's recent report on the private network industry, Timeplex accounts for approximately 22% or $152 million of a worldwide market estimated to amount to $704 million in 1990. Revenue of $152 million represent approximately 65 to 70% of Timeplex's total revenues. Other product areas such as statistical multiplexers and X.25 packet technology, as well as services, make up the bulk of the remaining revenues.

The Doelz acquisition brings a source of revenue in house. Unisys had been acting as an original equipment manufacturer (OEM) for Doelz packet-switching systems for more than two years through its financial industry division, particularly in branch-banking applications.

Doelz's products will now be incorporated into the Timeplex product line. Doelz, with approximately 60 employees, will remain in Irvine. The name will be changed to Doelz Technical Center. Osman expressed confidence that Timeplex could build on Doelz's existing sales.

Prior to the acquisition, Timeplex had already begun broadening its product line. The firm joined the ranks of T3 multiplexer vendors earlier this year, and it also entered the high-speed local area network connectivity market with its Fiber Distributed Data Interface (FDDI)-based routers, intelligent concentrators and routing bridges.

Says Carl Pitasi, vice president of Stamford, Conn.-based Gartner Group Inc., "The recent product announcements and acquisition moves have restored Timeplex to the front line." ▭


Data, Video Will Flood Network

The data stream of the mid-'90s will be clogged with local area network and video traffic.

Source: Timeplex Inc.

MARKET INSIGHTS

AN ANALYSIS OF ECONOMIC TRENDS

Federal IS Spending Is Still Growing

BY MADELINE FRANCHI
Cahners Economics

Despite the continued likelihood of cutbacks in overall federal spending this year and next, the U.S. government still remains one of the largest markets for information systems purchases.

According to the Electronic Industries Association, information technology accounts for $20.3 billion of the total FY1991 federal budget. The EIA expects federal spending on information systems to grow at an average annual rate of 4.5 to 5.5% through 1995.

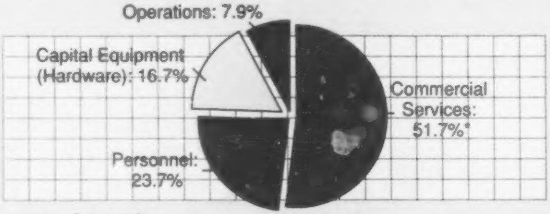
Not surprisingly, the Department of Defense (DOD) has control over the bulk of the dollars spent on IS, being responsible for $9.2 billion, or 45%, of total spending this fiscal year. Four other agencies—the National Aeronautics and Space Administration (NASA), the Department of Energy, the Environmental Protection Agency and the Department of Transportation—share 19% of the dollars, or $3.9 billion.

Strong increases in government spending on information systems will actually be limited to a few selected agencies. NASA's share of the budget will expand 35% by FY1995, from the current $1.7 billion to $2.3 billion. In contrast, while DOD information system spending will continue to rise by a modest 2 to 3% per year, the DOD's share of total government information systems spending will fall from its present 45% to 40% by 1995. Even so, because of the large amounts of dollars involved, the DOD will remain an important market for the information systems industry.

For more information on Cahners Economics's forecasting services, contact Dan Buchanan at (617)-630-2105, by fax at (617)-630-2100 or write to him at Cahners Economics, 275 Washington Street, Newton MA 02158.

Federal IS Spending: The Big Picture

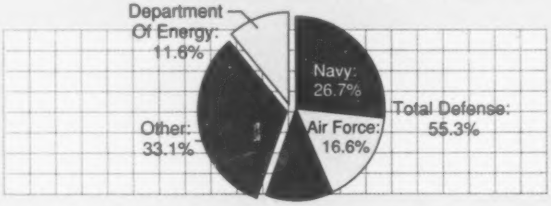
U.S. government spending on information technology (FY1991 budget)



*Includes systems integration

Source: Federal Computing Inc., *Government Computer News.*

U.S. government installed base of information systems**



**percent share of total dollar value in place through 1989

Source: U.S. General Services Administration

	Actual		Forecast (Annual % growth)		
	Q2/90	Q3/90	1990	1991	1992
Gross National Product	0.4	1.8	1.1	1.9	2.9
Business Investment In Equipment	-3.4	8.2	2.3	3.5	3.6
Government Spending	6.2	1.3	2.5	0.5	0.9
Consumer Spending	0.2	3.6	1.2	1.5	2.5
Exports	-5.0	1.2	5.1	2.8	5.6
Imports	0.7	6.0	3.4	2.1	3.0

All calculations are % change in 1982 dollars; quarterly figures are seasonally adjusted annual rates.

Manufacturing Production (1)	August	July	% Change 8/90-7/90	August 1989	% Change 1990-1989
Process Industries Total	109.1	109.1	0.0	108.4	0.6
Chemicals	109.5	109.4	0.1	109.6	-0.1
Petroleum	108.4	109.0	-0.6	107.0	1.3
OEM Total	114.1	114.5	-0.3	112.4	1.5
Computers & Peripherals	149.9	149.3	0.4	139.3	7.6
Communication Equipment	110.9	110.8	0.1	106.0	4.6
Transportation Equipment	108.6	109.1	-0.5	107.8	0.7
Services Employment (2)					
Finance, Insurance, Real Estate	6.935	6.937	0.0	6.821	1.7
Health Care	8.021	8.174	0.3	7.628	7.5
Computer & Data Processing	0.809	0.806	0.4	0.756	7.0
Transportation/Utilities	5.854	5.842	0.2	5.566	5.2
Retail Trade	19.950	19.946	0.0	19.745	1.0
Wholesale Trade	6.416	6.417	0.0	6.327	1.4
Government	17.242	17.478	-1.4	16.730	3.1

(1) Index 1978=100, seasonally adjusted
(2) Millions of persons, not seasonally adjusted

Source: Commerce Dept. and Cahners Economics

MARKET INSIGHTS

A SURVEY OF TECHNOLOGY TRENDS

Needed: Better Client/Server Development Tools

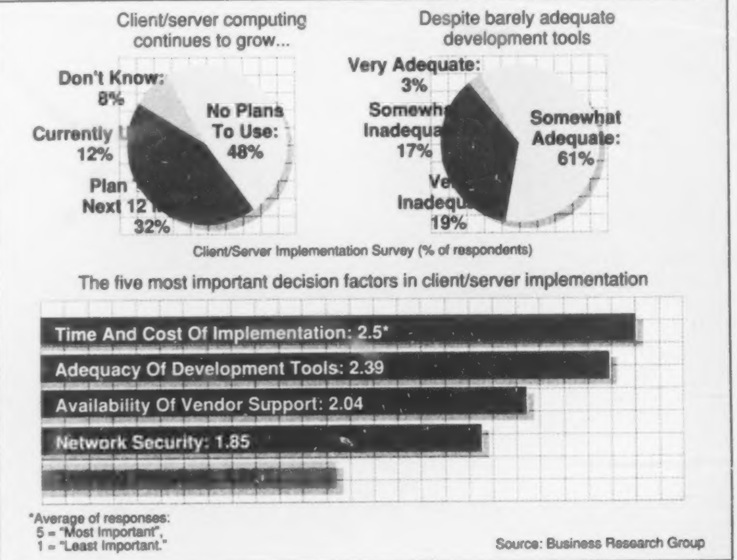
BY WARREN CHILDS
Business Research Group

Although 74% of the members of the DATAMATION High-Technology Panel are now running or soon plan to run 386-based local area network server systems complete with PC desktop clients, only 12% say they have actually implemented true client/server computing, defined as processing shared between client workstations and server hosts.

Users cite two factors hindering the speedy implementation of true client/server computing: high costs in terms of the dollars and time needed to install these systems and a lack of adequate development tools to easily and quickly create client/server applications.

When asked about development tools currently available for client/server applications, only 3% of our panel members said they consider the tools on the market today very adequate for their needs, whereas 19% said they consider them very inadequate. Another 17% consider them somewhat inadequate. ☐

What's Holding Back Client/Server Growth?



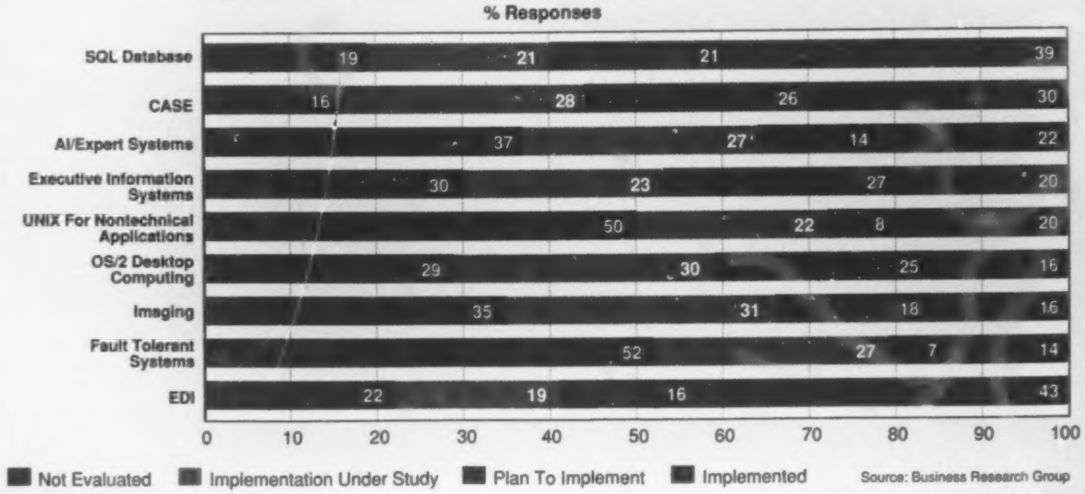
*Average of responses:
5 = "Most Important",
1 = "Least Important."

Source: Business Research Group

For more information, contact Nancy Finn at (617)-964-6204, by fax at (617)-558-4402 or write to her at Business Research Group, 275 Washington Street, Newton, MA 02158.

DATAMATION's Technology Implementation Index: Systems And Software

DATAMATION each month surveys a select group of its readers–the DATAMATION High Technology Panel–to investigate the implementation of new technologies by key user organizations.



Source: Business Research Group

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A CAHNERS PUBLICATION

DATAMATION

FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE

JANUARY 1, 1991

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Ray Noorda, Novell's CEO, with NetWare

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DATAMATION

FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE

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NetWare 386 is intended to provide the glue that bind LANs with larger systems.

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Novell's Enterprising NetWare 30

BY BOB FRANCIS King of the stand-alone departmental local area network, Novell is working to make NetWare 386 more of a team player on large, mixed internetworks.

Cover photography by Tim Kelly/Black Star

SPECIAL REPORT

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BY DATAMATION STAFF Slow growth is expected in most traditional industry equipment segments over the next 12 months. But there are bright spots: software, laptop PCs, workstations and services.

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BY JOHN McMULLEN Equipped with network connections, a growing number of spreadsheet users are knocking on the door of corporate databases. Will you let them in?

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BY SUSAN KERR Rising sales volumes and a move to develop 100Mbps wire-based networks are pushing the price of optical FDDI network gear to affordable levels.

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BY JOHN McMULLEN Up to their elbows in crusty old spaghetti code, why should maintenance programmers care about CASE? Index Technology's Design Recovery tool is one reason—it chews up spaghetti and spits out CASE models.

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UNIX Gurus Develop A New System 69

BY JEFF MOAD Just when you thought UNIX might really become a standard, Bell Lab's Ken Thompson and a team of researchers are at it again, developing yet another portable—but centralized—operating system.

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The Fed Reserves An Imaging System 71

BY TED BUNKER For the 12 banks that belong to the United States Federal Reserve System, processing 20 billion checks a year is a nightmare. Switching to an image system could save money, headaches and paper—not to mention jet fuel.

SYSTEMS

MINICOMPUTERS

AT&T Breathes Life Into Mini Line 73

BY TED BUNKER AT&T is finally moving from proprietary minis to computers based on industry-standard RISC processors and its own standard operating system, UNIX System V, release 4. It could be just in time.

IBM's Imageplus transaction-processing system might make the picture clearer for the Federal Reserve's check processing, page 71

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INSIDE DATAMATION

Novell's Vision Of The Enterprise

These days, the idea of the network is much in vogue. All computing roads, the conventional wisdom would have us believe, lead to the network. Corporations are determined to bring order to their often incompatible computing resources, and they'll do this by creating all-encompassing networks that will link these resources efficiently and effectively to serve the corporation and its users.

Sound like a worthy goal? We think so, but we're also quite aware that the road to this new world of what some are calling enterprise networks will not be an easy one. Much has yet to be learned about the crafting of heterogeneous networks, and the learning curve may have a steep arc. That's why the approach taken by such companies as Novell in constructing networks bears watching closely.

In this issue's cover story, "Novell's Enterprising NetWare," page 30, Dallas bureau manager Bob Francis takes a close look at Novell, an acknowledged force in local area networking operating systems. Novell has a view of crafting enterprise networks that could be described as a building block approach coupled with a realistic view of what's already in place in many companies. Says Raymond J. Noorda, Novell's president and chief executive officer: "What we have to do is provide an environment where companies can preserve their data, this huge mass of data that they've written through the years. We have to make sure that data is safe and secure and, at the same time, provide a useful platform for applications. Also, we have to provide service and support for that. I say we, but it's not just us, it's the whole industry. We can't walk away from that."

FRANCIS: Do all roads lead to networks?

With its connectivity plans consisting of support for IBM's Systems Application Architecture (SAA), the UNIX operating system and Apple Macintoshes, Novell is clearly intent on casting a net beyond corporate departments to larger sites and organizations. It has to. Stand-alone networks are becoming as inconceivable to corporate IS strategy as are stand-alone PCs. As Novell goes forward with its plans for NetWare, pay close attention. The lessons learned may make your own journey down the road to enterprisewide networks a little less bumpy.

Crystal Gazing For 1991

A favorite game this time of year is predicting what will happen throughout the coming months. But it's a game with pretty high stakes for both consumers and producers of information technology products and services. So DATAMATION's editorial team fanned out across the industry to get a fix on what might happen in 1991 in PCs, workstations, networks, software and systems, both here and abroad.

What we came up with, I think you'll agree, is a comprehensive look at an industry in change economically and technologically. Many industry segments—including general purpose business PCs and minicomputers—will experience little if any growth this year. But high-end workstations, laptop computers, software and services should do fairly well. The wild cards, of course, are elements larger than the IT industry itself—the national economy, consumer confidence, the Persian Gulf. How they will play out is anybody's guess, but one thing's for sure: there will be plenty of excitement for all.

David R. Brousell, Editor

Coming Next Issue

- The State Of OS/2
- COMDEX Report
- What's Hot In Laptop Software
- The Latest In High-Speed Protocols

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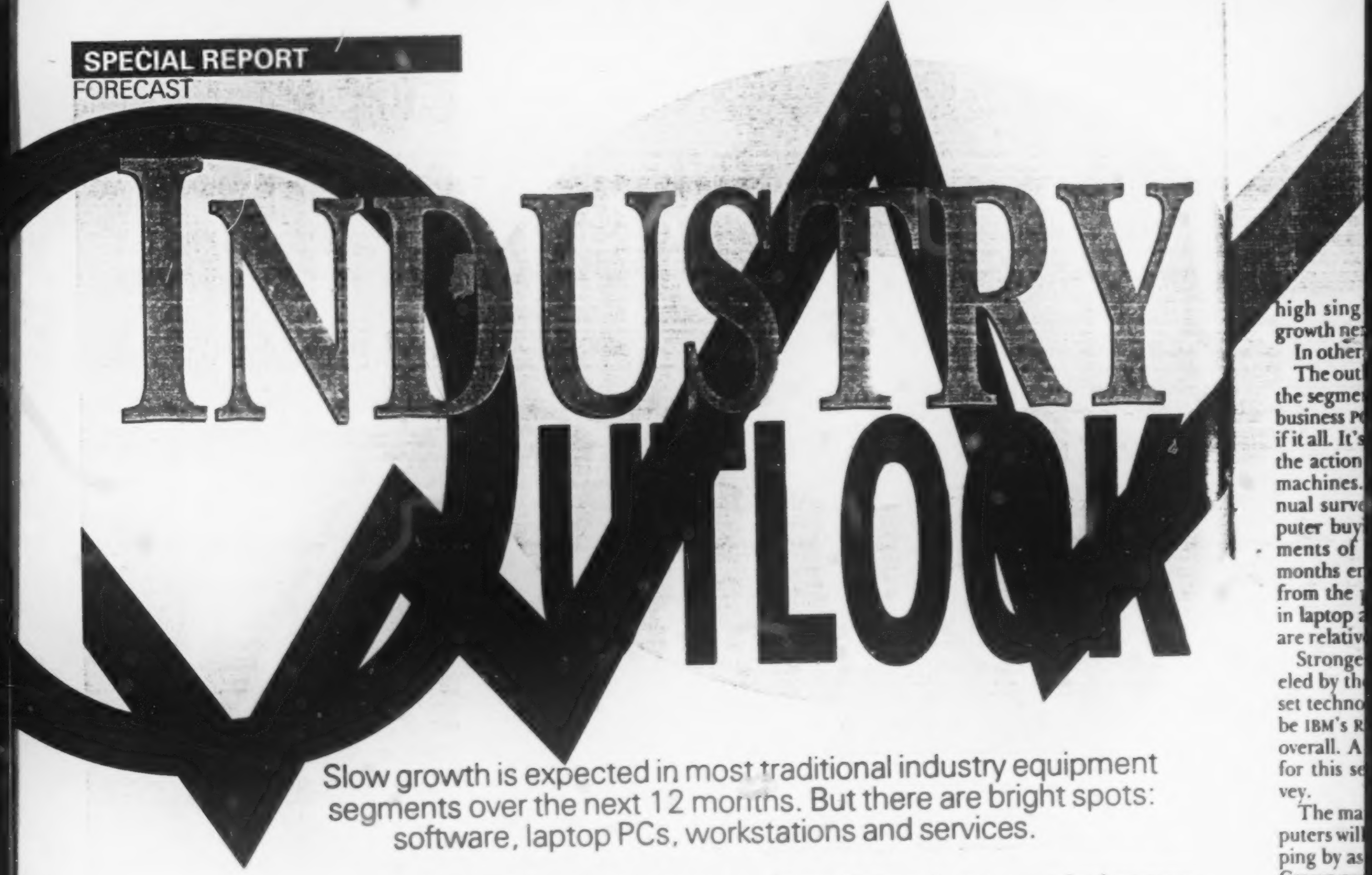

INDUSTRY OUTLOOK

Slow growth is expected in most traditional industry equipment segments over the next 12 months. But there are bright spots: software, laptop PCs, workstations and services.

For IS managers, the watchwords of the new year are "downsizing," "outsourcing," "do more with less." And for many of the companies that supply them with information technology products and services, the corresponding chant is "flat," "on hold," "in transition."

What's wrong, mostly, with the IT marketplace is what's wrong with business and with the economy in general. A lack of confidence, a fear of recession, tougher competition and an unstable international situation caused by tensions in the Persian Gulf are all contributing to a cautious business mood. This caution trickles down to IS budgets, which in turn trickles down to the balance sheets of industry suppliers.

IS budgets in some companies may rise only 5 to 8% in 1991, barely covering cost of living increases for personnel. And these will be the lucky ones. Other departments, part of companies going through larger business retrenchments, will be slashing costs and muttering the dreaded 'O' word—outsourcing.

But beyond economic considerations, IS departments and the companies that supply them have their own peculiar dynamics.

Going on all through this, of course, is the technological transition to lower cost desktop systems and standards through which the industry is headed. On the heels of this transition is the follow-on desire in many companies to craft these innumerable desktops into some rational web that management will believe serves a corporate business purpose.

These changes at the IS consumer level are reverberating at the IS supplier level. Equipment vendors are taking it on the chin. Suppliers are shifting their economic bases from what had been a low-volume, high-margin production model to the brave new world of high volumes and low margins, causing wrenching adjustments that will continue in 1991. Already, the total number of employees cut from such U.S. suppliers Apple Computer Inc., Digital Equipment Corp. and Unisys Corp., as well as such European suppliers as Ing. C. Olivetti & Co. SpA, Groupe Bull SA and NV Philips' GL has reached into the thousands. News of corporate reorganizations has become commonplace. And Wall Street has taken a sledgehammer to valuations of high-tech stocks.

The irony is that computing, driven by the combination of technological advances and a more affordable economic model, is spreading like wildfire. For IS managers, control is the issue; for suppliers, the problem is making a buck they can live on.

But as 1991 unfolds, new opportunities will be apparent. Much in demand will be graphical user interfaces, with their ability to make computing easier and accessible to more and more people. Networking products, productivity-advancing software, laptop- and notebook-size computers, systems that can act as so-called servers in information networks and integration services will also be in demand, fueling growth for companies positioned to deliver them. Mainframe-class computers, driven in part by the start of a new IBM product cycle, may experience

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high single-digit, if not outright double-digit, growth next year—for the first year in a long time.

In other market segments, here's the scenario:

The outlook for personal computers, in particular the segment of the market that consists of standard business PCs, may grow only in the low single digits, if it all. It's largely a replacement business now, with the action for '91 being in migration to 386-class machines. DATAMATION/Cowen & Co., in its annual survey of IS managers' mini and microcomputer buying intentions, projected that unit shipments of PCs will increase about 8% for the 12 months ending in June 1991, down several points from the prior year. But rapid growth is expected in laptop and notebook PCs, the markets for which are relatively pristine.

Stronger growth is anticipated in workstations, fueled by the cutting-edge use of reduced instruction set technology. The big winner here is expected to be IBM's RS/6000 line, which is driving the market overall. A 31% surge in dollar growth is projected for this segment by the DATAMATION/Cowen survey.

The market for traditional, proprietary minicomputers will be stone cold in '91, with shipments dropping by as much as 8%, according to DATAMATION/Cowen projections. In other segments, such as UNIX, forecasts of a 40% growth rate in commercial midrange and workstation sites will warm things up, but the real hot spot seems to be systems positioned as network and/or file servers, such as the class of system typified by Compaq Computer Corp.'s SystemPRO computer. The one anomaly in the proprietary minicomputer category is IBM's AS/400, which is expected to continue to do well in 1991.

In the networking arena, double-digit growth rates are expected in such applications as peripheral sharing, file sharing/transfer, database/host access, electronic mail and groupware. The Cowen survey expects greater penetration of departmental and sitewide networks—now at 52% and 30%, respectively—in 1991, as well.

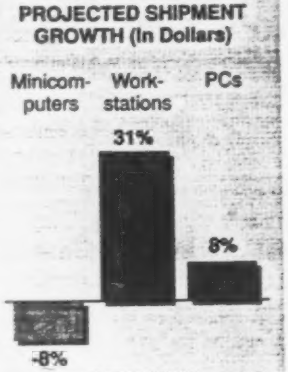
The PC software market should be, as they say, robust. The subindustry created by Microsoft Corp.'s Windows program will see much activity—and perhaps an early shakeout, as well. Database management systems, playing an important role in client/server computing, may enjoy astounding growth, as much as a 172% increase, according to the DATAMATION/Cowen survey.

All in all, the new year will shape up to be one of gradual change based on a new, and evolving economic model for both consumers and producers of information technology. As this evolution occurs, 1991 may end up being the year of the journey to a new era in computing, a trip that may be more important than the destination itself.

—*David R. Brousell*

Where The Growth Is

Through the first half of 1991, sales of workstations will fare best.



Source: DATAMATION/Cowen & Co.

Following are 1991 outlook reports in four industry segments: Systems, Networks, PCs & Workstations, Software and International.

▶SYSTEMS

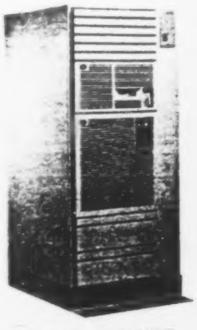
IBM Expects Growth Of 7 To 10%

As the recession causes customers to delay capital spending, weakened midrange and large-scale systems vendors are reexamining strategies they've long employed. Most are ensuring that they have scalable and "open" product lines that include innovative and cost-efficient technology. Some companies are changing product directions; all are stressing their ability to provide software and services. Some systems vendors are laying off hundreds to thousands of people both here and in Europe. Although it's a painful time for some companies, the mood is patient and cautiously optimistic.

IBM, for instance, expects growth in the 7 to 10% range, a projection that hasn't changed much since 1990, although officials do say growth could be at the low end of that range in 1991. IBM expects to grow this much because, a company source says, it believes its product line is "particularly well set up for the moment," with products like the RS/6000 workstation, ES/9000 mainframe and the AS/400 midrange system.

IBM continues to focus on base semiconductor technology. It expects, for example, to be among the first commercial vendors of 16-megabit dynamic random access memory (DRAM) devices by 1992. And IBM is already working on 64MB, 256MB and 1-gigabit DRAMs.

IBM believes it will have to introduce new semiconductor production technology before it can come out with a 256MB device. To prepare for this, IBM expects to become the first private owner of a special light source for X-ray lithography sometime in 1991. Such advances are important to IBM users who are anxious to turn their mainframes into efficient data warehouses, with much of the actual processing going to desktop PC client systems.



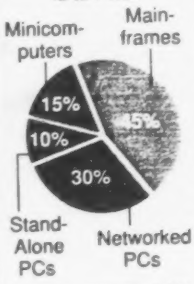
WITH PRODUCTS LIKE THE ES/9000, IBM believes its product line is "particularly well set up for the moment."

Economic Aftershocks Hit Digital

At Digital Equipment Corp., the news is less positive. With 57% of its business outside the United States, Digital had for some time been counting on

Where Distributed Applications Are Going

Mainframes are still the preferred hardware platform for new development, but the trend is to PCs.



Source: DATAMATION/ Cowen & Co.

the healthy international economy to bolster its business. But, as the Japanese and many European economies slow, Digital is reeling. "If there is any contraction in world economies, we will feel it," says Mark Steinkrauss, director of investor relations.

The company plans to reduce its employee head count some 5,000 to 6,000 people by June, the end of its 1991 fiscal year. That would represent about a 4 to 5% decrease in staff from its first-quarter FY91 level of 123,500.

Research and development spending is shrinking slowly, as well. In the late 1980s, R&D grew by approximately $200 million to $300 million a year, says Steinkrauss. But the $1.5 billion the company plans to spend on R&D in FY91 represents a drop from the $1.6 billion, or 12.5% of revenues, it spent the previous year. Despite this gradual slowdown, Steinkrauss calls the $1.5 billion a "very high proportion of revenues." And, says Digital spokesperson Brad Allen, the flow of new products will continue unabated in both hardware and services, as product development times shorten.

Digital is furthering its distributed database offerings by focusing on client/server computing and stepping up promotion of its standby database system, Rdb, which is installed at more than 15,000 sites worldwide. The company is also concentrating on mainframe-style computing as well as on systems integration.

Service: Rx For Health

Spokesperson Allen says that systems integration has a particular attraction for Digital. "Systems integration is growing in double digits," he states, adding that the company will capitalize on that growth, which amounted to revenues of more than $1 billion by late last year. System integration, says Steinkrauss, "is a great way to add value. . . . How many people can take on the MIS needs of a Boeing or a Kodak?"

Electronic Data Systems Corp. believes it can. Indeed, as data center managers continue the current trend of consolidation and outsourcing, IT providers such as EDS are doing well. EDS director of marketing Barry Sullivan says such IT providers can expect to see market growth of 17 to 20% in the United States this year. In Europe, says Sullivan, IT services could grow by as much as 30% in 1991, as European Community-based companies prepare for the unified market slated to become reality on January 1, 1993. EDS is trying to match these industrywide growth rates, says Sullivan.

The Dallas-based company is focusing on technologies that support three broad areas of computing: distributed, client/server computing; multimedia; and technologies that support development and maintenance of applications software, such as computer-aided software engineering.

EDS is trying to standardize on key technologies for distributed computing in the areas of network management, systems management and distributed data management. The company is standardizing on Open Systems Interconnection (OSI) and UNIX, for example.

In multimedia, EDS is working with a number of hardware and software vendors to understand and implement products for complex records management and for storage and retrieval of video and voice data. The company is focusing on integrating multimedia with business applications rather than on building stand-alone applications. EDS is also attempting to formulate standard software development methodologies that can be promulgated throughout an organization.

Minimakers Hurting

Changes in the way customers are doing business as a result of the economic slowdown may be good for service companies like EDS and may hold promise for Digital's systems integration business, but they're not so good for traditional minimakers. In Palo Alto, Hewlett-Packard Co. is feeling the effects of the recession.

HP treasury manager Joe Zaelit reports that, late last year, orders were growing in the "high single-digit area, a little lower than historically we have experienced, and a little lower than we'd like to see." The economy determines the health of HP/Apollo's minicomputer business, says Zaelit: "What will happen to the economy . . . determines what capacity your customers need—how much computing power they want to expand or replace." Nevertheless, the company is optimistic about the high end of its HP 3000 minicomputer line. HP's high-end UNIX-based systems are "doing well," reports Zaelit.

Slow growth is also the forecast at Unisys Corp. in Blue Bell, Pa. Like HP, the company expects demand for hardware and software in the single digits in 1991. However, demand for services could grow at a faster rate, says Everett Ehrlich, vice president for financial and economic analysis. The company plans to pursue revenue growth while continuing to reduce its $3.2 billion debt load by some $600 million to $800 million.

Economic troubles in certain sectors could help Unisys, says Ehrlich. "When structural change happens, we get called in." Banking, retailing and insurance industries, which Unisys has targeted in recent years, are undergoing "times of crisis," as Ehrlich puts it, and are looking for ways to cut costs, improve productivity and enhance products. These industries are trying to improve the way they use information in order to compete more effectively, he says.

Unisys spent much of last year polishing its image as a provider of open systems based on industry-standard processors and operating systems. Users welcome the change. "They are now trying to provide the links between proprietary and open systems," says Bernard Bachmann, first vice president of Union Bank of Switzerland in Zurich and a past president of the Unisys Users Association in Europe.

Unisys continues to upgrade its mainframe technology and during the latter half of this year is expected to introduce the Gladiator, a new version of its 2200 series mainframe. ▭

—Elaine Appleton, Ted Bunker, Jeff Moad, Paul Pinella

UNISYS'S EHRLICH: polishing its image as a provider of open systems based on industry-standard processors and operating systems

INDUSTRY OUTLOOK 91

▶NETWORKS

Solid Gains Seen For Networks, EDI

"We don't see the economy slowing down the networking trend. The potential is greater than ever before and particularly for corporatewide PC networking."

That's what James D'Arezzo, vice president of marketing at Banyan Systems Inc. in Westborough, Mass , says about the coming year. His colleagues at network companies generally agree.

Novell Inc. of Provo, Utah, for example, sees 15 to 20% growth in revenues next year. But the company is expecting more than 50% growth for NetWare 386 over 1990's $70 million in sales.

If there is any tempering of optimism among network-related vendors, it is on the communications hardware side. That's where questions about the economy may dog managers constructing capital equipment budgets.

D'Arezzo would not comment on Banyan's forecast (it's a private company), but Banyan is one of many suppliers that see growth coming from customers who already have nets installed. To meet the needs that large-scale local-area/wide-area networking produces, Banyan is focusing on two fields in the coming year. The firm expects good results from its symmetric-multiprocessing version of VINES, one of the few network operating environments that fully leverage the capabilities of the new generation of multiple processor LAN servers.

Reflecting the increasing heterogeneity of corporate internetworks, Banyan is also working on stepping up its offerings for diverse client workstations. It's a good bet that Macintoshes and PCs running OS/2 will be integrated into VINES in 1991.

EDI Is Hot

The increasing connection of computers at corporate sites is matched, perhaps surpassed, by the growth in data transmission over phone lines. At least one of the reasons is the growth of electronic data interchange (EDI) and internal electronic business communications.

"Transaction volumes are going through the roof," says Paul Zoukis, vice president of marketing for General Electric Information Services in Rockville, Md., a value-added network provider with a strong position in EDI. "EDI usage took off after the '89–90 holiday season. We have 8,000 EDI clients, and they doubled their usage last year."

Zoukis says that GEIS's mail business grew about 40 to 50%. He says that clients no longer consider EDI and e-mail as luxuries—they're seen more as core business necessities. Next year, Zoukis expects 50% growth in the volume of EDI transactions worldwide and similar expansion in electronic business communications. He's concerned, however, that some of the smaller EDI customers will have to delay purchases in a slow economy.

GEIS will focus on industry-specific software development in the coming years, such as the work it recently completed for the transportation industry. And GEIS is working with its parent, Fairfield, Conn.-based General Electric Co., to develop an X.500 naming service that, in conjunction with in-place X.400 gateways, will allow users (and applications) to easily address messages without knowing the exact e-mail address of recipients.

In addition to taking advantage of value-added networking services, many users continue to have private networks. Last year surpassed AT&T's expectations for private line services, says Norm Sperling, product manager for AT&T's Business Special Services group in Edminster, N.J. Sperling says growth rates will be even higher in 1991.

The major push in demand for data communications services is coming from the increasing interconnection of LANs over wide areas, particularly over T1 (1.54 megabit-per-second) lines. Sperling says at least half, and possibly more, of T1 traffic is now taken up by data, rather than voice. At least one factor drawing users to these services has been lower prices. But Sperling looks for stabilization in private line pricing in the coming year.

As far as the equipment needed to connect to the public and private networks, Per Suneby, director of corporate development for Codex Corp. of Mansfield, Mass., sees great regional differences in international buying patterns. "We're seeing a real risk of a major slowdown in the U.S. because of the U.S.'s vulnerability to a recession." In contrast, Suneby sees a healthy business in Europe and the Far East.

Users in all three regions are buying equipment for digital networking, with market growth in the midteens. LAN/WAN interconnection devices will grow at 30 to 40% a year in 1991, Suneby says. He thinks network management products will expand at a 20%-a-year clip in 1991.

James J. Fiedler, executive vice president of Timeplex Inc., says some equipment purchases will be motivated by a desire to take advantage of the increasing services offered by telephone companies. "The ability to run a hybrid network is becoming more and more paramount," says Fiedler.

"Our overall outlook," Fiedler continues, "is that in the wide area network part, that is the T1 business and the wide area, on a worldwide basis we see growth almost the same as this year, which is over 20%. I think the U.S. will be flat, not nearly as robust as it was during the past two years. We're looking for high single-digit, low double-digit growth."

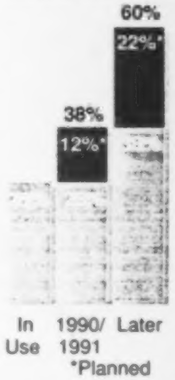
Perhaps Darrell Miller, executive vice president of Novell, best sums up the effects of the economic downturn on the coming year in networking: "Our plans are cautiously optimistic. Cautious because we read about a slowing of the economy and optimistic because we're a cost-effective technology and have cost-effective solutions to customers' needs. In an economic downturn, we see customers migrating to our segment of the industry." ▭

—Mark Schlack, Tom McCusker

Double-Digit Growth For Networks

Organizationwide networks will grow at a fast clip in 1991 and beyond.

% OF SITES WITH NETWORKS



*Planned

Source: DATAMATION/ Cowen & Co.

BANYAN'S D'AREZZO: Sees growth coming from customers who already have nets.

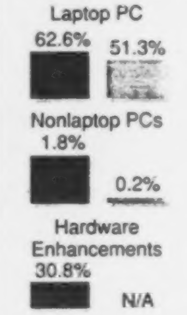
▶ **PCs & WORKSTATIONS**

RISC, Multiprocessing Are The Hot Spots

Laptop Growth Catches Fire

In both units and dollars, sales of laptops will blow past 50% growth for the 12 months ending in June 1991.

PROJECTED SHIPMENT GROWTH



■ **In Dollars**
▨ **In Units**

Source: DATAMATION/ Cowen & Co.

The uncertain economic climate of 1991 tempers the enthusiasm of all major players in the PC and workstation industry segment. With U.S. sales slowing and overseas revenues dependent upon an unpredictable European economy, many suppliers are hesitant to forecast sales for the entire year. "We are reluctant to project too far out today," admits Joe Zaelit, treasury manager at Palo Alto-based Hewlett-Packard Co. Michael Swavely, president of Compaq North America, is a little less cautious. He says 1991 industry growth will be 10 to 15% worldwide.

Such optimism may be justified, considering that PC and workstation companies are on the favorable side of the downsizing trend and therefore fairly well protected against budget trimming. With recession wary customers reluctant to invest in large-scale capital expenditures, the smaller system suppliers are apt to continue growing at the expense of their big-system competitors.

Smaller And Faster

On the new-product front, 1991 bodes well for some interesting announcements in the symmetric-multiprocessing (SMP) arena. Last year, Compaq added Intel 80486 power to its SystemPRO SMP server and is now working with Novell Inc. to develop fault tolerant system software to work with it. And NexGen Microsystems Inc., a San Jose, Calif., company in which Compaq has a minority stake, is reportedly developing a superscalar microprocessor compatible with Intel's 486 chip. The NexGen chip is not due until the first half of 1991 and could later become the centerpiece in a scalable system from Compaq.

Workstation market leaders will continue to leapfrog one another using reduced instruction set computing as the springboard. Late last year, IBM and Sun Microsystems Inc. both added high-end workstations to their product lines. The power curve this year may be further extended through SMP technology at the single-user workstation level. "Our focus at the high end over the next year will include multiprocessing, high throughput and networking," says Cheryl Vedo, vice president of product marketing for Sun's General Systems group. Regarding the prospect for a new SMP workstation, Vedo says, "that's a distinct possibility."

With Sun and IBM on a workstation roll and now both pursuing the vast business market beyond engineering, Digital Equipment Corp. and Hewlett-Packard will be pressed to regain lost momentum. Says HP's Zaelit: "Our PCs have been fairly spotty recently, and our workstation business has been flat for the last three quarters. But you can expect to see new products in 1991." Digital, too, is likely to unveil a new generation of workstations based on the R3000A RISC chip from Mips Computer Systems Inc. of Sunnyvale, Calif.

At the low end of the PC market, industry leaders Apple Computer Inc. and IBM launched systems last year aimed at the home, small-business and network node niches. The IBM PS/1 and the Apple Macintosh Classic are just the first salvos in a forthcoming barrage of low-end systems due out this year.

Most analysts predict that the real double-digit growth will happen in the red hot notebook PC market, although sales of PCs based on the 486 chip are expected to pick up as well. Compaq's new LTE 386s/20, announced last year, was among the first of a new breed of 386SX-based laptops to flood the market. The LTE is now being pursued by dozens of clones, which will drive prices down. One such competitor, the NEC ProSpeed SX/20, can be equipped with up to 5 megabytes of random access memory and a 40MB hard disk. Meanwhile, analysts say that 1991 will be the year that Apple finally invites a Japanese manufacturer to build what it could not—a lightweight notebook Mac. ▭

—Paul Pinella, Bob Francis

▶ **SOFTWARE**

Software Execs In Upbeat Mood

SAS'S GOODNIGHT: A recession, if it should occur, shouldn't affect SAS. He expects another 15% revenue hike this year. "Europe's already forecasting 30% growth."

Although software industry leaders agree that 1991 will be a difficult year for the world economy, few expect the slide in general economic growth to hurt them. In many cases, in fact, industry leaders see benefits for their companies from the slowdown.

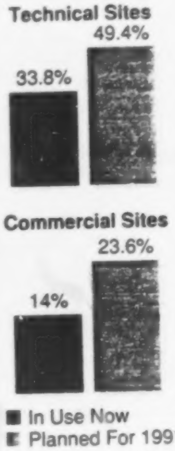
Says Charles B. Wang, chairman and chief executive officer of Computer Associates International Inc., "We can all agree that we're uncertain about what the economy's going to do over the next 12 or 14 months. People are becoming mindful of spending." That means software vendors with efficiency-promoting products could benefit from a weakening economy.

Wang is hopeful that the company's new CA90s architecture strategy, intended to tie many of its products together, will reap dividends. He also expects strong growth in the company's system management product line, as users responding to the industrywide move to hold the line on costs more aggressively implement programs to monitor system performance. Other suppliers of systems management software concur.

Aubrey Chernick, chairman of Los Angeles-based Candle Corp., points out that, in times of economic uncertainty, spending priorities shift toward mission-critical applications and to software that can help improve system performance and control costs.

UNIX Comes On Strong

UNIX will become the operating system of choice at more commercial and technical sites in 1991.



Source: DATAMATION/Cowen & Co.

Sales of IBM's DB2 relational database management system might suffer, for example, at the same time that sales of DB2 performance monitors rise.

Explains Mario Morino, executive vice president of the IS management division of Legent Corp. in Vienna, Va.: "We're in a counter-cyclical segment of the industry. We normally see a noticeable pickup in interest in systems management and performance-improving software when times are tough."

In the large-scale IBM mainframe market, software companies are watching carefully IBM's introduction of the new ES/9000 mainframe family. James Goodnight, president of SAS Institute Inc. in Cary, N.C., is casting a wary eye on the new IBM equipment. The reason Goodnight has reservations about whether the ES/9000 line may benefit software companies like his is that the overall population of mainframes is continuing to shrink.

Even though SAS, and other companies, price their software according to CPU size and will therefore reap increased revenues from individual licenses when selling products for the larger machines like the ES/9000, such moves are not enough to offset the shrinking population, Goodnight says. "The problem is that people tend to swap two [machines] for one," he says. "We're able to sell more expensive software on the newer machines, but there are just fewer of them."

As a result, over the last several years, SAS has broadened the scope of its products to embrace midrange computers and PCs.

Dun & Bradstreet Software Services Inc., the fourth largest U.S. software company, with $450 million in revenues, is also bullish about 1991: "1991 should be a good year," says D&B chairman John P. Imlay Jr., a member of DATAMATION's Advisory Board. "During tight economic times, companies are more likely to buy packaged software than [to] try to create it in house." Imlay also expects the economic slowdown to accelerate the corporatewide trend toward integration of midrange and workstation platforms with mainframe hosts. As a result, D&B plans to broaden its midrange and workstation product lines this year.

Lotus Development Corp. is looking to international sales to bolster a potentially lagging U.S. market for PCs and supporting software. To emphasize its global presence, Lotus plans to maintain a 50/50 ratio of international to domestic business, says Frank King, senior vice president of Lotus's software business group. King says Lotus is strong in Europe and Japan, where hardware shipments remain strong too; the company will turn its efforts to the Pacific Rim for growth in order to counter a possible shortfall in U.S. sales this year. Says King: "We're a global company, and we're relying on these efforts to make up any difference in our domestic sales."

PC Software Is Softening

Lotus, which rolled out a steady stream of products running on a wide range of hardware platforms in 1990, will flesh out its spreadsheet product line to include several more in 1991.

Lotus originally balked at moving to a Windows 3.0 graphical user interface (GUI) and put all its money on OS/2, which has been slow to take off among corporate users. "We're as disappointed as the rest of the industry about OS/2," says King.

Microsoft has a new focus for the decade, says Frank Gaudette, senior vice president and chief financial officer at the Redmond, Wash., company. Says Gaudette: "Personal computing will become a much stronger factor in corporate America in the coming decade, and we're going to continue to emphasize products that are easy to install and modify, that provide easy-to-use graphical access to personal information and that approach computing as a bottom-up process."

Over the long term, the company will focus on three strategic product areas, he says—object-oriented technologies, multimedia and handwriting recognition. To help make all this happen, Microsoft plans to hire an additional 750 R&D workers, increasing the total research and development staff a whoopping 38% to 2,700. ▭

—J. William Semich, John McMullen

▶ **INTERNATIONAL**

Recession Hits Europe

"The user is very confused today. The only reasonable decision is to wait." Although these are the words of Bruno Lamborghini, vice president, corporate strategic analysis and planning for Ing. C. Olivetti Co. SpA, they could come from any European computer vendor.

Coming off a booming European market for information technology in 1988 and 1989, customers in 1990 adopted a wait-and-see attitude about capital expenditures that should deepen this year. Most major players—International Computers Ltd. (ICL), Groupe Bull SA, Memorex Telex NV, NV Philips'GL, Olivetti and Siemens-Nixdorf Informationssysteme AG (SNI)—have been confronted with users that are confused about vendors' positions concerning proprietary and open systems.

Customers are also clamping down on spending, as concerns about the Middle East situation continue, the worldwide economy slows and businesses rethink their own strategies in order to prepare for a single European market in 1993. European computer vendors battled with U.S. suppliers in 1990, as prices of U.S.-made systems and software, affected by the weakness of the dollar, grew more attractive to European customers.

Vendors are scrambling to address customers' concerns and revitalize the badly drooping marketplace. European suppliers are following strategies that mirror those of U.S. systems manufacturers: changes in architecture; aggressive spending on research & development, particularly on open systems; decisions to reduce the sizes of direct sales forces and rely more on indirect sales; massive layoffs; and industrywide consolidation, the latter most obviously demonstrated by Siemens AG's acquisition of Nixdorf Computer AG and Fujitsu Ltd.'s acquisition of 80% of ICL.

OLIVETTI'S LAMBORGHINI: Investing in multimedia, laptop computers, software and services.

Only software and service companies are still doing well. Cap Gemini Sogeti, the leading European IT services provider, expects to grow at least as fast, if not faster, in 1991 as the 30% the European industry is projected to grow. Last year was also a period of fast growth for the company, which swelled 43% from 14,000 employees in 1989 to 20,000 in 1990.

Cap Gemini secretary general Michel Berty explains the reasons for such growth: "Information technology is becoming part of the [business] strategy of the firm. So [users] invent new demands."

Berty predicts that in 1991 electronic data interchange (EDI) will gain in popularity. So, he thinks, will outsourcing, as projects become increasingly complex. "The trend is to subcontract more and more. . . . Clients could develop [their IT projects] themselves, but they don't have the same resources [that IT service providers do.]"

Weakened hardware vendors smell money in the services business and are rapidly shifting their resources to software and services. Troubled systems vendor Groupe Bull, in one of a number of significant restructuring actions, last year moved 60% of its direct sales force into software, customer service and training. Jean-Claude Albrecht, president of Bull SA (France), expects software, service and training to realize revenues of FF$500 million (about $100 million) in 1991. Bull SA's service revenues are growing at 41% a year, says Albrecht—much faster than the service industry's growth and faster yet than sluggish worldwide hardware growth, which is less than 10% annually.

Bearish On Bull

Groupe Bull needs the money. It lost more than $500 million in 1990, causing many in the industry to question the long-term viability of the company, which is partially funded by the French government. In November 1990, the company announced it will lay off 5,000 people worldwide by the end of this year, with almost 80% of those layoffs to take place in North America and the rest in France. These layoffs follow a work force reduction last year of 2,500. By the end of 1992, the company will close seven of 13 manufacturing plants around the world.

The company is also restructuring its product offerings, placing more emphasis on UNIX and on a distributed architecture, says Ward Mackenzie, executive vice president of corporate product line management. It plans to introduce interconnections between its proprietary GCOS operating system and UNIX-based applications.

Olivetti Down But Not Out

Last fall's shocking news from Groupe Bull was followed within days by Olivetti's announcement that it will reduce its 57,000-strong work force by 7,000 people this year. As with Bull, layoffs and early retirement programs are not new to Olivetti: in 1989 and 1990, the company cut 5,500 jobs. Profit margins are narrowing for companies like Olivetti that rely on standard, commodity products such as DOS- and UNIX-based PCs. Olivetti's profits were 41% lower in the first half of last year than they were in the same period of 1989, down to L60.9 billion ($54 million) from L102.6 billion ($92 million).

Olivetti's Lamborghini, like most company officials nowadays, wants to look at the bright side: the company is "still profitable; our profits declined, but what is important today is to still have profits, not to measure the rate of decline."

While professing not to measure declining profits, the company is indeed measuring the needs of its customer base. Along with a commitment to UNIX shared by systems vendors worldwide, Olivetti is investing in multimedia, laptop computers and software and services. It will continue supporting banking applications, where it has seen some success in Europe but has been hurt in the United States by the failing thrift industry.

SNI Pulls Together

At Siemens-Nixdorf, new president Hans-Dieter Wiedig is leading the company's efforts to merge the existing product lines of Siemens Data Systems and Nixdorf Computer AG. The company, formed in October 1990, said last fall that its combined revenues would exceed DM13 billion (about $8.6 billion) by September 30, 1990. In 1990, Siemens's mainframe business grew 30%, with much of that growth being replacement business from Siemens's own systems market, says Wiedig. In mid-1991, the company plans to introduce a 170-million-instruction-per-second mainframe in response to IBM's System/390; SNI will try to come close to IBM's price/performance ratios with its current and new systems.

The UNIX market has been a challenge for the new company. Wiedig admits that Siemens broke even on UNIX hardware sales in January 1990. The company will struggle to turn a profit on UNIX platforms, says the president: "We must try to break even—we haven't until now because Nixdorf's problems are very heavy ones." To meet the challenge, SNI is merging Siemens's SINIX line of UNIX-based systems with Targon, Nixdorf's line of UNIX platforms. "By the end of 1992, we will have a line with one applications software interface," Wiedig says. SNI plans to run that common applications program interface on both complex and reduced instruction set computers as well as on fault-tolerant machines. ▭

—Elaine Appleton, Tim Mead

Retirement Programs For Older PCs

Many companies must now decide how best to upgrade an installed base of vintage computers. But they don't have to work alone. A growing regiment of suppliers is eager to help plan your PC retirement program.

BY JEFF MOAD

Congratulations.

After several months of careful study, you're finally ready to propose to management a new strategic PC plan for your corporation. It's brilliant, of course. Following a four-month pilot project, the company will migrate to a new graphical user interface environment and a new suite of graphical applications. The new corporate standard will be a 33-megahertz 80386 machine with 2 megabytes of memory, field upgradeable. How can they say no?

There's just one problem. Many of those desks on which you plan to place a gleaming new 386 machine are already occupied by far less glamorous pieces of PC hardware. 286 machines. ATs. Even XTs, growling data off of floppy disks. What do you do with those?

A growing number of IS executives are being forced to deal with that question. They've decided to move to graphical environments such as Microsoft Windows 3.0 or OS/2's Presentation Manager, which work best with the speed and power of 386 technology. But they and their users are saddled with thousands of older PCs.

In the current era of lurking recession and cost cutting, it's unlikely that management will agree to scrap the older machines or give them to charity, even if they are fully depreciated. And simply passing the old box to the next desk down the corporate food chain has its drawbacks. For one thing, those lower-level, first-time PC users were supposed to be among those who would benefit from the new, easier-to-use graphical environments.

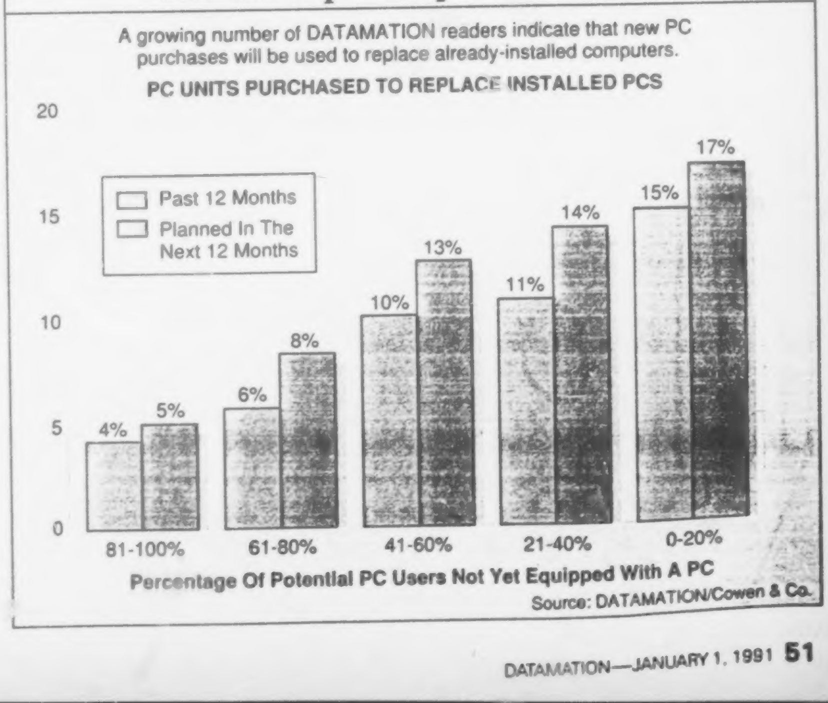
In an effort to help corporate PC planners—and make it easier for them to buy new equipment—several vendors and retailers have begun offering users some unusual deals. Dealers such as Businessland Inc. and ComputerLand Corp. are telling large corporate users that they will buy back older PCs at a fixed price and replace them with new gear over a period of time. Even some PC vendors are getting in on the act.

Let's Make A Deal

PC vendor Grid Systems Corp. of Fremont, Calif., for example, recently proposed buying several hundred older 286-based PCs from the wholesale banking group at Wells Fargo Bank in San Francisco and replacing them with new 386-based Grid desktop and portable machines. Grid would then try to dispose of the older machines by placing them with independent remarketers of used equipment.

IS officials at Wells, who want to run Windows 3.0 on the new 386 machines, are still evaluating the Grid proposal. "But we're pleased they're taking this approach," says Tom Eagan, vice president and manager of the Wells Wholesale Network. "It's attractive because a lot of those older machines are coming off the books, and this would allow us to bring in the new machines and not have to pay much more than we're paying now." Besides realizing a tax benefit on the new equipment, Eagan figures he'll get between $500 and $550 for each of

The Run Up In Replacement PCs



Source: DATAMATION/Cowen & Co.

the old 286 machines.

Officials at Grid declined to discuss their proposal to Wells. And they insisted they have no formal, generally available program to buy back older PCs. Vendors like Grid seem to be willing to extend such deals only to very large corporate users willing to buy hundreds or thousands of new PCs.

Retail Gets Into The Act

Many analysts, however, believe vendors will have to become more open and aggressive about helping users dispose of their older PC gear. "It's something they're all going to have to take more seriously. There's a lot of 286 or below equipment out there that has to go somewhere," says Jim Hickey, manager, in Boston, of the PC solutions practice for G.E. Consulting Services Corp. of Rockville, Md.

In fact, Computer Intelligence, a research firm in La Jolla, Calif., estimates that 40% of the installed base of corporate PCs in the United States is still 8088- or 8086-based. And 81% is 286 or below.

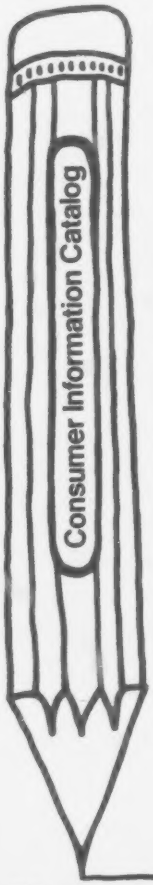
Retailers also are moving to help users replace those older machines. Businessland and Apple Computer Inc., for example, recently cut a deal with Hughes Aircraft Co. to buy about 1,000 older PCs and replace them with new Apple and IBM systems. Businessland and Apple structured the deal so that Hughes could turn in the old equipment over a four-month period at predetermined rates that decline over time. Hughes officials, who wanted to bring in the new equipment without increasing the percentage of PC-equipped workers, estimate that they will save up to $500,000 by selling off the used equipment.

☐ SIMPLY PASSING THE OLD BOX DOWN THE CORPORATE FOOD CHAIN HAS ITS DRAWBACKS.

Businessland officials stress that the Hughes deal was a singular arrangement. But they say they may formalize a program to buy old PC equipment.

ComputerLand also has been helping large customers get rid of their older PCs. Earlier last year, the Hayward, Calif.-based retailer quietly signed an agreement with American International Credit Corp. of New York under which the two offer to purchase and lease back a customer's installed PCs for a limited time while the customer develops a plan for replacing the old gear. According to ComputerLand senior vice president Al Andrus, the program, called "Planned Obsolescence," places installed systems under operating leases as short as six months, then replaces the old systems at the end of that period. ComputerLand already has put together nine such deals. The largest had a value of $9 million, Andrus says.

Of course, not all users are candidates for such elaborate replacement schemes. Many will continue to simply move older systems, as they are replaced by new PCs, to the desks of lower-level employees. But for a significant number of users who may be approaching PC saturation or who want consistent technologies throughout the organization, selling older equipment back to the vendor or dealer may be an attractive alternative. ▭



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MARKET INSIGHTS

AN ANALYSIS OF ECONOMIC TRENDS

Iraqi Jitters Jolt IS Performance

BY MADELINE FRANCHI
Cahners Economics

In August 1990, the DATAMATION Information Systems Performance Indicator (ISPI) dropped to 98.8, its lowest level since April 1987. Cahners Economics had originally expected the indicator to come in at 99.84 for August, but Iraq's invasion of Kuwait depressed the elements that make up the indicator further than expected. When the Middle East situation spooked the financial markets, the computer stock price index tumbled to 168.67 from 193.65 the month before. Another sign of the business retreat was the slippage of new orders for information systems and for new plant and equipment in general.

From July to August, new orders for information-processing equipment nosedived almost 12%; orders were down by 2.7% compared with August 1989 levels, marring a record of steady annualized increases amassed since September 1989.

Nevertheless, this one-month setback should not derail the longer term growth in demand the industry had been experiencing prior to the oil shock. For the 12 months ending in August 1990, new orders totaled $118.2 billion—an increase of 9.2% from the previous 12-month period. And even in August, some sectors remained strong; net new orders for communications equipment actually increased 12.7% over the level of August 1989. ▭

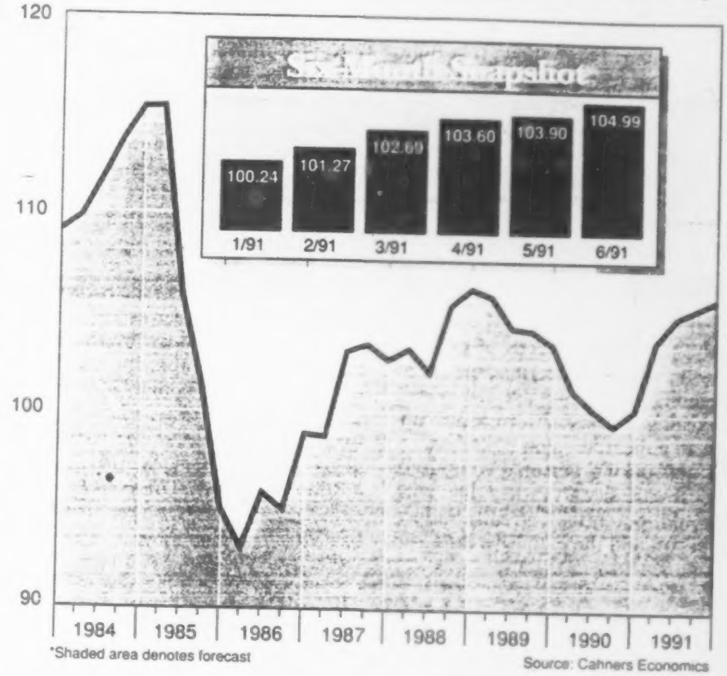
For more information on Cahners Economics's forecasting services, including seminars, newsletters and database diskettes, contact Dan Buchan at (617)-630-2105, by fax at (617)-630-2100, or write to Cahners Economics, 275 Washington Street, Newton, MA 02158.

Methodology

The DATAMATION Information Systems Performance Indicator tracks the economic health of the IS industry. Cahners Economics developed this indicator, which is based on weighted moving growth rates for five statistics: (1) IS inventory, (2) new IS orders, (3) average weekly hours of computer industry employees, (4) Standard and Poor's Computer Systems Stock Price Index and (5) contracts and orders for plant and equipment.

The IS Performance Indicator

Despite Iraqi market jitters, our forecast still shows improvement is on the way.



*Shaded area denotes forecast

Source: Cahners Economics

	August 1990	July 1990	% Change 7/90-8/90	August 1989	% Change 1989/1990
■ **Information-Processing Equipment**					
Shipments (SA, $ billions)	9.76	9.69	0.7	9.50	2.7
New Orders (SA, $ billions)	9.35	10.58	-11.7	9.60	-2.7
Unfilled Orders (SA, $ billions)	28.79	29.20	-1.4	27.78	3.6
Inventory (SA, $ billions)	21.41	21.19	1.0	22.10	-3.1
■ **Computer Production Workers**					
Employment (NSA, thousands)	273.2	274.8	-0.6	292.8	-6.7
Average Weekly Hours (monthly avg.)	41.5	41.1	1.0	42.1	-1.4
■ **Stock Index**					
S&P's Computer Systems Stock Price Index	168.67	193.65	-12.9	194.72	-13.4
■ **Contracts & Orders**					
New Plant & Equipment (SA, $ billions)	38.92	43.38	-10.3	41.68	-6.6

SA= seasonally adjusted;
NSA= not seasonally adjusted

Sources: U.S. Commerce Dept. and Standard & Poor's;
Forecasts: Cahners Economics

MARKET INSIGHTS

A SURVEY OF TECHNOLOGY TRENDS

Users Wait For Faster Wireless LANs

BY WARREN CHILDS
Business Research Group

The latest survey of DATAMATION's High-Technology Panel shows that only a handful—just 6%—have either implemented or plan to implement wireless local area network technology. And few are evaluating wireless LANs for future implementation, either, with only 16% of our panel members studying the possibility of installing them at their sites.

Although general interest is high—some 59% say they're at least somewhat interested in wireless LANs—the technology is still not developed sufficiently to meet the production needs of most IS shops, where communications speeds of 10 megabits per second are the norm. Most existing wireless LAN products operate at an unbearably slow 9,600bps.

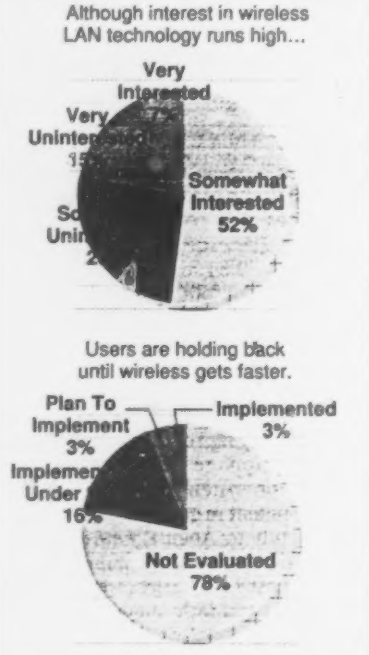
Still, networking personal computers with microwave signals rather than with wires could, potentially, greatly reduce the high cost and the extensive time and inconvenience required to install LANs. The cost of wiring a 10-workstation LAN, not including adapter cards and software, can reach $3,000—counting the time and labor required to snake wires, drill through concrete floors and track circuits for shorts or breaks.

And a few vendors have recently announced products that break the 9,600bps barrier. Princeton, N.J.-based O'Neill Communications Inc. offers its Local Area Wireless Network (LAWN), with a throughput of 19.2Kbps, for example; NCR Corp. has announced its Waveline, with throughput as fast as 2Mbps; and most, recently, Motorola Inc. has announced its Wireless-In-Building (WIN) system, rated at 15Mbps.

But until these super high-speed products ship and are generally available, wireless LANs will most likely continue to be of interest mainly to small businesses typically driven more by the need to share peripherals than by the requirements of true LAN applications. ▭

For more information, contact Nancy Finn at (617)-964-6204, by fax at (617)-558-4402 or write to her at Business Research Group, 275 Washington Street, Newton, MA 02158.

Look Ma, No Wires!

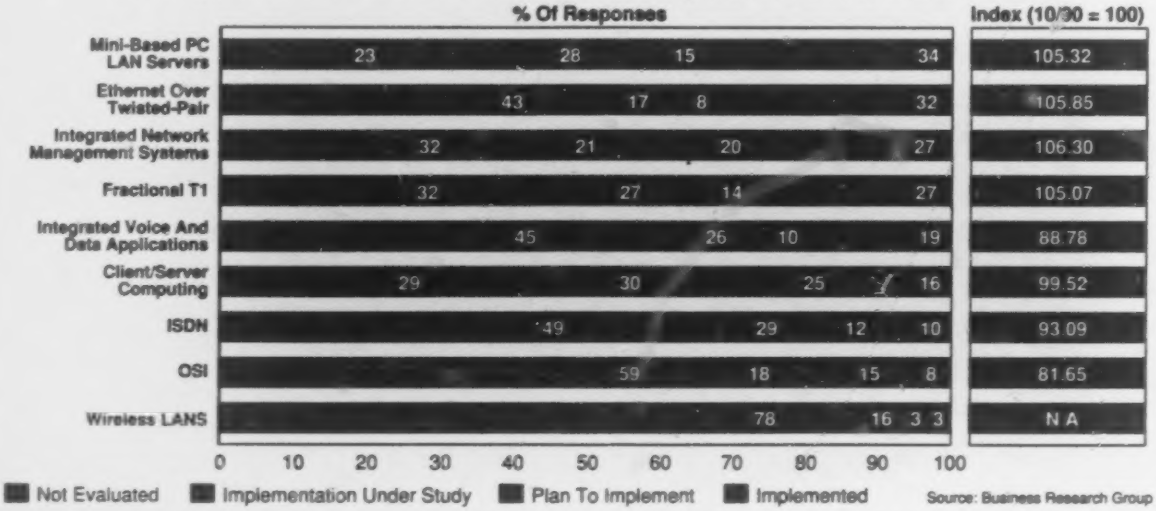

Although interest in wireless LAN technology runs high...

Users are holding back until wireless gets faster.

Source: DATAMATION, Business Research Group

DATAMATION's Technology Implementation Index: Networks/Communications

The DATAMATION Technology Implementation Index is designed to track the rate of implementation of emerging technologies. Each month, DATAMATION surveys a panel of its readers and asks them to rate their level of implementation for each technology. Over time, this index will show the rate at which technologies are gaining acceptance by the user community.



Source: Business Research Group

SPECIAL REPORT: What's Best For IS From COMDEX *page 98*

A CAHNERS PUBLICATION

DATAMATION

FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE

JANUARY 15, 1991

OS/2
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OS/2 Full Screen
Print Manager
OS/2 System Editor
OS/2 Command Reference
Information
Introducing

Leland Reiswig, IBM vice president of programming, with OS/2

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Where IS Stands On OS/2

page 30

What's Hot In Laptop Software *page 43*

The Latest In High-Speed Protocols *page 48*

EIS Prices Finally Get Real *page 65*

Tools To Manage Big Projects *page 71*

Xerox's Enterprisewide Printer *page 79*

Microsoft Makes It Easier To Excel *page 89*

Market

Local Area Networks

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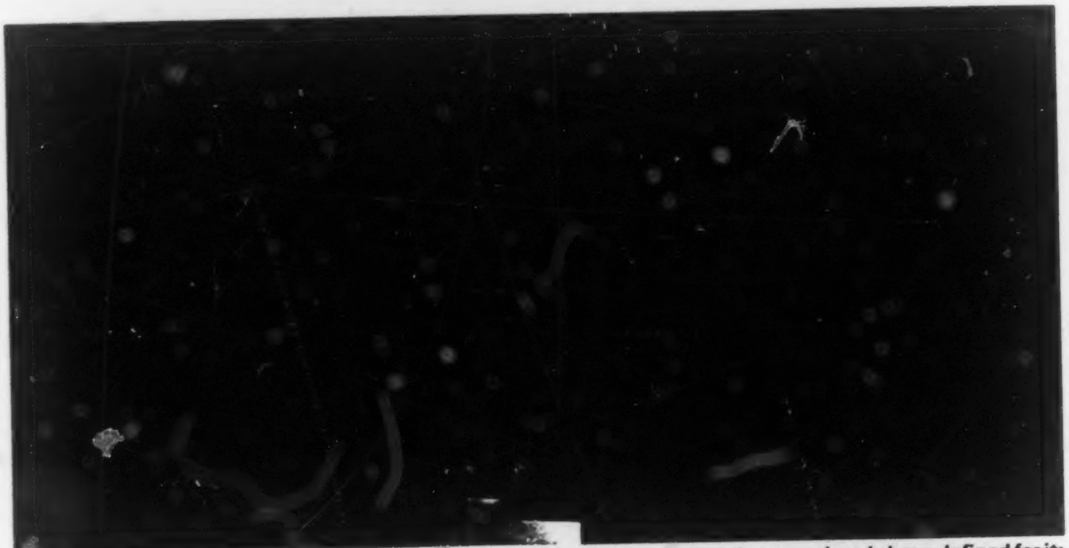
JANUARY 15,
1991

DATAMATION

FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE

VOLUME 37
NUMBER 2



As OS/2 gains in power and performance, it is moving more solidly into the role users already have defined for it: a platform for internally developed, business-critical applications.

COVER STORY

OPERATING SYSTEMS

Where IS Stands On OS/2 30

BY JEFF MOAD Those looking for new productivity packages will find that OS/2 is in for a long winter's nap. But IS managers working on tomorrow's corporate code are convinced that OS/2 will prevail.

Cover photography by Alan Orling/Black Star

SPECIAL REPORT

COMDEX

What's Best For IS From COMDEX 98

BY DATAMATION STAFF Back from Las Vegas, the DATAMATION editorial staff places COMDEX in perspective by highlighting the most interesting new products to strut their stuff at the world's largest computer show.

PRODUCT GUIDE

FEATURE

Microsoft Makes It Easier To Excel 89

BY MIKE RICCIUTI Excel—Microsoft's spreadsheet for Windows, OS/2 and the Macintosh—gives number crunchers power and flexibility in an easy-to-use package.

Microsoft Ex
Rec c or

Hank Vigil says Excel 3.0 offers flexibility and easy-to-use power.

FEATURES

PCs & WORKSTATIONS

PORTABLES

What's Hot In Laptop Software 43

BY BOB FRANCIS Companies routinely earmark thousands of dollars for portable PC hardware. But deciding what software to use with these mighty miniatures is an equally important part of the buying decision.

Custom PC software helps FDIC bank examiners check the accuracy of financial data.

NETWORKS

PACKET SWITCHES

The Latest In High-Speed Protocols 48

BY TOM McCUSKER Networks that use high-speed backbone lines to combine data with voice, image or other applications can benefit from this high-throughput communications protocol.

WIDE AREA NETWORKS

Frito-Lay's Network Recipe 57

BY BOB FRANCIS Mix 240 LANs with high-end PCs, super servers and OS/2 applications; stir with satellites; bake in central mainframes and out comes a corporate network that's broad yet centrally managed.

SOFTWARE

EIS

EIS Prices Finally Get Real 65

BY DAVID STAMPS Vendors of mainframe-based executive information systems are finally smartening up. They're moving EIS downscale to run on PCs and Macs, and they're finally pulling prices down.

PROJECT MANAGEMENT

Tools To Manage Big Projects 71

BY TOM McCUSKER Juggling too many oversized application development projects? Try the latest project management software. Some can even take charge of your CASE tools and hook them into the best methodologies.

SYSTEMS

PRINT SERVERS

Xerox's Enterprisewide Printer 79

BY JEFF MOAD Xerox is combining copier, printer and, in the not-too-distant future, networking technology to be first out with an integrated print server.

DEC

Digital Nudges Open The Doors To VMS 83

BY TED BUNKER Digital's ULTRIX didn't satisfy users hungry for application portability and commercial power. So Digital is adding POSIX and XPG3 to VMS in order to cook up a robust solution.

Pilot's Friend steers a course for EIS affordability, page 65.

Xerox Execs Lowe and Hicks move into a new world of digitized information, page 79.

Digital's Olsen answers the call for open systems, page 84.

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INSIDE DATAMATION

OS/2 Is Just Where It Should Be

Maybe Bill Gates was right after all when he said that compared with DOS any other operating system could be viewed as an also-ran. What he was talking about, of course, was OS/2, the PC operating system that was originally touted as the successor to DOS for new generations of increasingly powerful hardware. As the installed base of DOS reaches toward 40 million, fair comparisons with other technologies are tough. It's like IBM; How do you compare other computer companies fairly with IBM? The answer: very carefully.

Now this may come as a surprise, but there really should not be any surprise over PC users' allegedly slow acceptance of OS/2—at least not for people with a computer-industry perspective longer than a few years. The reality is that there is much precedence for what has happened to OS/2. It's the same phenomenon that occurs anytime a system achieves widespread installation. Once the technology's in place and running, over time it gets harder to change. We at DATAMATION call this the Inertia Factor. Talk to shops running DOS/VSE, MVS, GCOS or OS/1100, to name but some venerable operating systems, to find out the true meaning of the term.

Nevertheless, OS/2, with more than 200,000 installations, is anything but a stepchild or an also-ran. According to our cover story this issue, "Where IS Stands On OS/2," page 30, the operating system has a different role to play than its older brother. Says senior writer Jeff Moad, "Users expect that versions of most major shrink-wrapped applications now available on DOS and Windows will be offered for OS/2, probably by 1993. But, for now, many see OS/2's strengths—preemptive multitasking, large memory space, strong interprocess communications, good security—as being best suited to complex custom applications that often involve moving some mainframe processing to PCs and local area networks. . . .

MOAD tests the strenghth of OS/2

"Now, despite all the recent talk of a rift between IBM and Microsoft, the two OS/2 partners have finally come to a fundamental agreement on at least one point: the PC market is a multiplatform market, and the split is defined by the functional needs of users."

And herein lies the challenge for IS managers, who, for strategic reasons, may be warming up to OS/2. Many of your clients in end-user computing won't easily relax their embrace of DOS, nor should they. It's up to you to defuse the potentially difficult political situation that may occur as OS/2 is introduced in your organization. Acceptance of a multiplatform world and coexistence of different systems is the practical strategy.

The Best Of COMDEX

Our Special Report this issue, "What's Best For IS From COMDEX," page 98, should tell you all you need to know about significant new products introduced at the COMDEX trade show in November. From notebook PCs, laptops and Windows applications to 486-based servers, multiprocessor machines and optical storage devices, what has become the industry's premier computer show had much to offer.

To cover the 1,850 exhibitors and thousands of new products, we assembled a team of DATAMATION editors and writers to sift out for you the products of most relevance to IS managers. We hope you find this report both comprehensive and fascinating.

David R. Brousell, Editor

Coming Next Issue

- Santa Cruz Operation's UNIX in perspective
- Can IBM reposition the mainframe?
- A look at Digital Research's DR DOS

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MARKET INSIGHTS

AN ANALYSIS OF ECONOMIC TRENDS

Expansion Is Around The Corner

BY MADELINE FRANCHI
Cahners Economics

Despite continued uncertainties raised by Iraq's invasion of Kuwait, we expect the U.S. industrial market to experience a mild expansion during the latter half of this year. And the computer industry will figure strongly in the turnaround.

During recent months, manufacturers' new, lean inventory policies, combined with strong international competitiveness, have helped to moderate the industrial slowdown. With inventories consistently at historically low levels, any pickup in demand for goods will translate into increases in factory production.

And in an ongoing effort to maintain global competition, U.S. factories continue to increase spending on new plants and equipment. Cahners Economics forecasts new plant and equipment spending by U.S. manufacturers will grow by 2.4% in 1991 and 4.6% in 1992.

Although that's significantly less than the 11% average annual gains of the prior three years, it's still stronger than the 10% drop recorded during 1986.

These increases in equipment spending will help maintain a strong IS industry this year, too; about one-third of all U.S. investment in capital equipment is for information processing and related equipment. According to DATAMATION's 1990 survey of U.S. firms' intentions to purchase mini and microcomputers, conducted with the Boston based securities house Cowen & Co., the manufacturing sector remains a big purchaser of information technology, in general, and of PC hardware and software in particular.

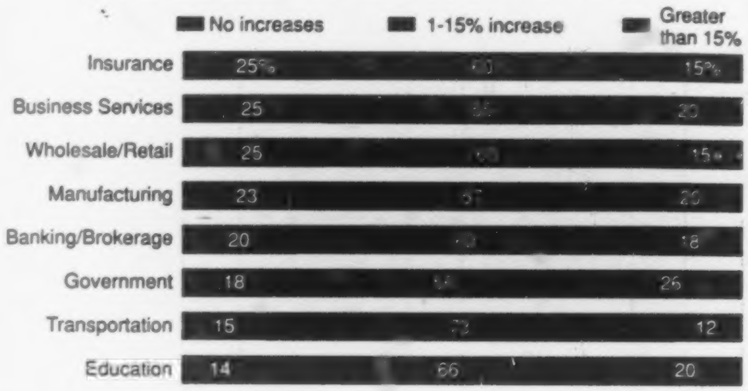
The survey found that, over the following 12 months, the manufacturing sector was expected to account for almost 27% of PC purchases in the United States. Over the next three to five years, 23% of the manufacturing sites predict they will increase their PC hardware and software spending by 15% or more. ▭

For more information on Cahners Economics's forecasting services, phone Dan Buchanan at (617)-630-2105, fax him at (617)-630-2100 or write to him at Cahners Economics, 275 Washington Street, Newton, MA 02158.

No Recession For PC Expenditures

Despite concerns over a slowing economy, private sector spending on PCs will remain strong over the next three to five years.

PC PURCHASING PLANS FOR THE NEXT THREE TO FIVE YEARS



Source: DATAMATION, Cowen & Co.

The Economy At A Glance

U.S. Economy: Macroeconomic And Industrial Indicators

	Actual		Forecast (Annual % growth)		
	Q2/90	Q3/90	1990	1991	1992
Gross National Product	0.4	1.7	1.1	0.9	3.1
Business Investment In Equipment	-3.3	10.1	2.3	2.4	4.6
Government Spending	6.2	0.6	2.4	0.5	0.8
Consumer Spending	0.2	3.2	1.2	0.6	2.5
Exports	-5.0	4.3	5.3	3.1	5.4
Imports	0.7	4.3	3.3	2.2	2.7

All calculations are % change in 1982 dollars; quarterly figures are seasonally adjusted annual rates.

	Sept.	August	% Change 9/90-8/90	Sept. 1989	% Change 1990-1989
Manufacturing Production (1)					
Process Industries Total	110.3	110.3	0.0	107.1	3.0
Chemicals	112.0	111.2	0.7	107.5	4.2
Petroleum	110.5	109.6	0.8	108.7	1.7
OEM Total	115.6	114.9	0.6	112.8	2.5
Computers & Peripherals	154.1	154.4	-0.2	141.8	8.7
Communication Equipment	110.7	110.9	-0.2	107.2	3.3
Transportation Equipment	110.7	107.6	2.9	108.0	2.5
Services Employment (2)					
Finance, Insurance, Real Estate	6.862	6.937	-1.1	6.764	1.4
Health Care	8.233	8.216	0.2	7.647	7.7
Computer & Data Processing	0.808	0.808	0.0	0.755	7.0
Transportation/Utilities	5.914	5.851	1.1	5.700	3.8
Retail Trade	19.872	19.965	-0.5	19.681	1.0
Wholesale Trade	6.379	6.409	-0.5	6.315	1.0
Government	18.024	17.157	5.1	17.612	2.3

(1) Index 1978=100, seasonally adjusted
(2) Millions of persons, not seasonally adjusted

Source: Commerce Dept. and Cahners Economics

MARKET INSIGHTS

A SURVEY OF TECHNOLOGY TRENDS

Users Want Better Network Controls

BY WARREN CHILDS
Business Research Group

Networks in most large companies today are a loose confederation of multiplatform systems managed by a wide variety of local network management software. But IS managers are increasingly demanding software that can control all of these systems from a central point.

The latest survey of the DATAMATION Technology Panel shows that 27% have already implemented integrated network management systems. An additional 13% plan to implement such a system within the next 24 months, 7% expect to do so at some undetermined time and 21% say they are actively evaluating such systems.

First on most users' vendor list for integrated network management systems, is IBM's NetView. A strong 55% of our panel members are considering NetView among their network management choices. Big Blue is committed to shipping a release of NetView 2.0 that will allow NetView to integrate management of non-IBM LU6.2 networks by September 1991.

Second on panel members' lists is AT&T's Unified Network Management Architecture (UNMA), under consideration by 37%. UNMA is a group of products in AT&T's Accumaster family.

Nearly a quarter of panel members—21%—are evaluating Digital Equipment Corp.'s Enterprise Management Architecture (EMA). Still largely incomplete, EMA will take charge of other vendors' network management systems through Digital's Management Control Center.

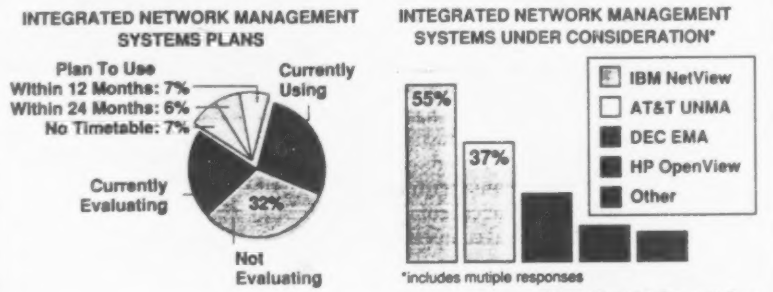
Only 11% of our panel are considering Hewlett-Packard Co.'s OpenView. OpenView is designed to operate with Open Systems Interconnection (OSI) networks.

For more information, call Nancy Finn at (617)-964-6204, fax her at (617)-558-4402 or write to her at Business Research Group, 275 Washington Street, Newton, MA 02158.

What Do We Want? Integrate Now!

Users are marching for integrated network management systems...

And IBM is leading the parade.

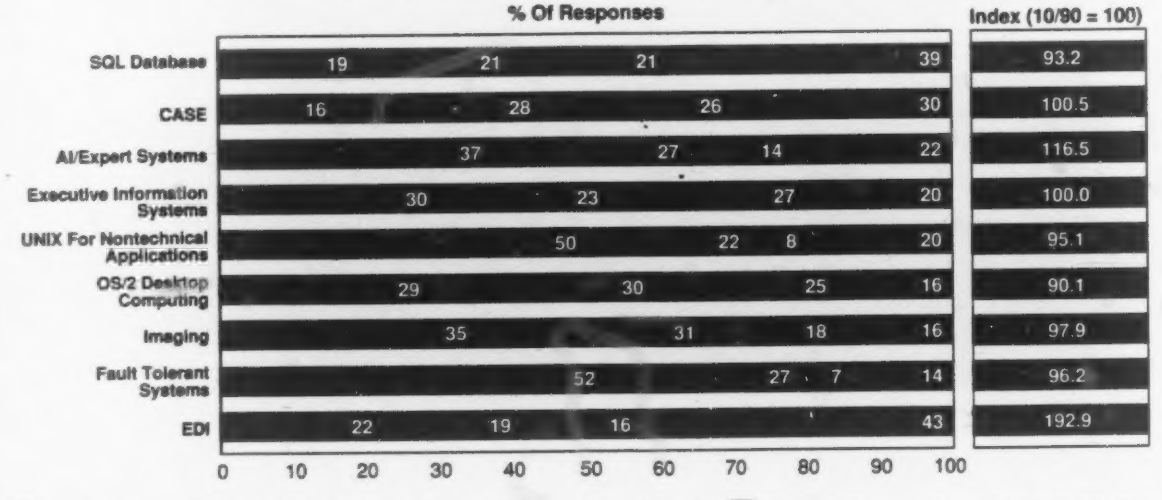


*includes mutiple responses

Source: Business Research Group

DATAMATION's Technology Implementation Index: Systems And Software

DATAMATION each month surveys a select group of its readers–the DATAMATION Technology Panel–to investigate the implementation of new technologies by key user organizations.



Source: Business Research Group

SPECIAL REPORT: Can Big Blue Reposition Big Iron? *page 54*

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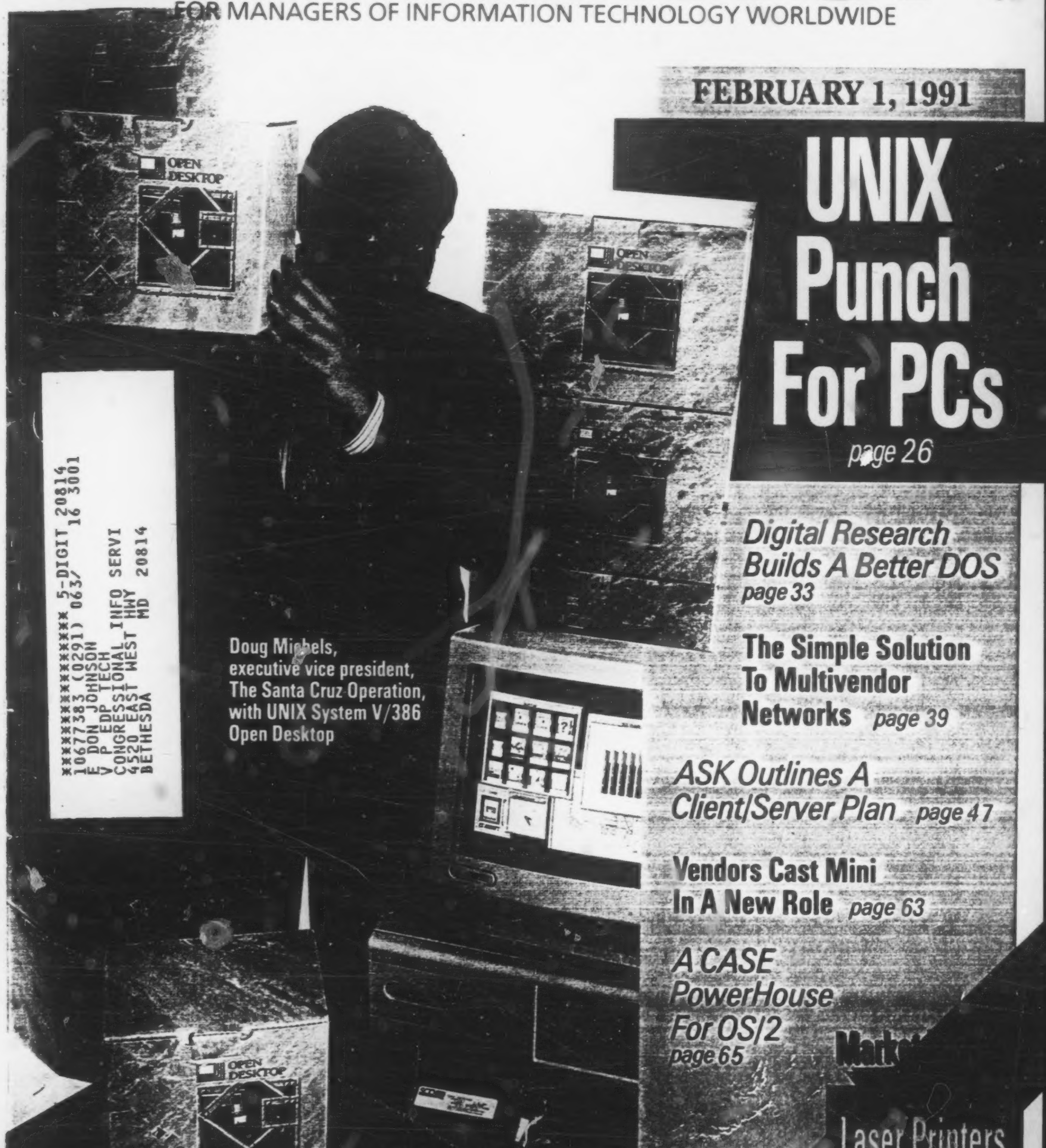

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ASK Outlines A Client/Server Plan *page 47*

Vendors Cast Mini In A New Role *page 63*

A CASE PowerHouse For OS/2 *page 65*

Marke

Laser Printers

Doug Michels, executive vice president, The Santa Cruz Operation, with UNIX System V/386 Open Desktop

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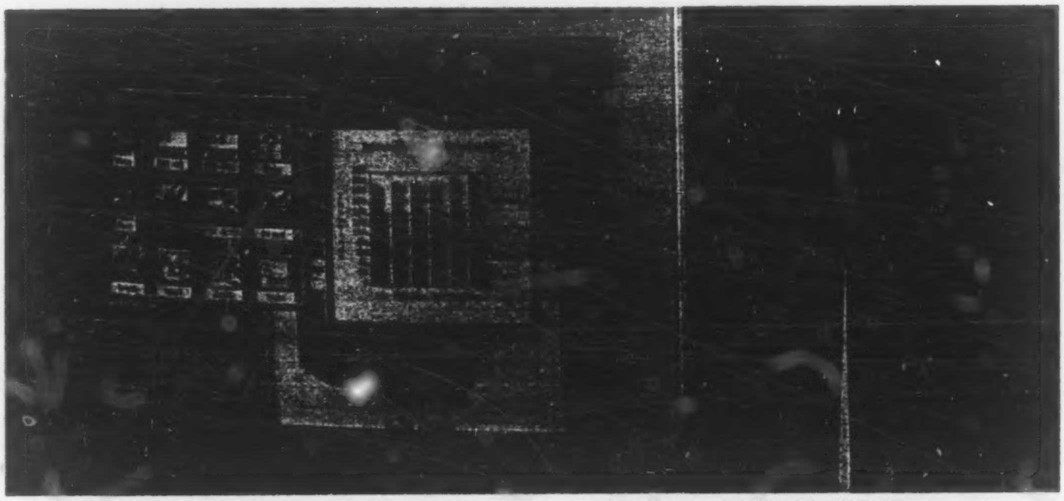
FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE

VOLUME 37
NUMBER 3



The Santa Cruz Operation's Open Desktop packs a wallop—a high-powered UNIX OS, RDBMS, network management system and X Windows GUI.

COVER STORY

SCO UNIX

UNIX Punch For PCs 26

BY PHILIP J. GILL SCO's UNIX System V/386 is a standards-based, multiuser, multitasking, cross-platform operating system for PCs, complete with unlimited memory—everything OS/2 wishes it had.

Cover photography by Chris Springman/Black Star

SPECIAL REPORT

IBM'S MAINFRAME STRATEGY

Can Big Blue Reposition Big Iron? 54

BY JEFF MOAD AND TED BUNKER

What IBM Says About Client/Server...

And How The S/390 Fits In

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A CASE PowerHouse For OS/2 65

BY MIKE RICCIUTI With PowerCASE, Cognos has introduced an application development system for OS/2 fully integrated with a fourth-generation language.

Peter MacKinnon sees PowerCASE's strength in tight integration between data and process modeling.

FEATURES

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OPERATING SYSTEMS

Digital Research Builds A Better DOS 33

BY JOHN McMULLEN Shut out of the big leagues for years, operating system pioneer Digital Research is enjoying quiet success with its intriguing DR DOS 5.0. But directly challenging Microsoft is a gutsy proposition.

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MANAGEMENT

The Simple Solution To Multivendor Networks 39

BY SHARON FISHER Makers of network communications gear are finally teaching their products to speak a common language—the Simple Network Management Protocol—which will make running multivendor networks a less burdensome task.

CONNECTIVITY

Mainframes With A Mac Face 43

BY MARK SCHLACK Making the physical link between Macintoshes and mainframes is no longer that daunting, but making it invisible to users can be. The latest connectivity software replaces clunky terminal emulation screens.

SOFTWARE

MANUFACTURING

ASK Outlines A Client/Server Plan 47

BY BOB FRANCIS A pioneer in minicomputer software, ASK Computer Systems Inc. is recasting itself as a born-again client/server company. The new software is still six months off, but customers want it now.

DATA MANAGEMENT

Classic Mainframe Software Moves To PCs 50

BY TOM McCUSKER Longtime IBM mainframe users have strong loyalties to some of the utilities they've been using for the past 20 years. Two of their favorites will soon be available on PCs running Windows 3.0 and OS/2 Presentation Manager.

SYSTEMS

MINICOMPUTERS

Vendors Cast Mini In A New Role 63

BY TED BUNKER Forecasting a gloomy future for stand-alone midrange computers based on proprietary operating systems, vendors are dressing up minis as open systems servers and hoping for the best.

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ASK's Kurtzig vows to lead the industry to client/server computing, page 47.

IBM's Conrades wants to help customers use standards, page 54.

HP's Roelandts sees his UNIX systems outselling the HP 3000, page 63.

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Ingres In Mac Clothing

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Systems
NetFrame Offers New Server

Networks
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MultiTech Weds A Fax And A Modem

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When UNIX Makes Sense

The open systems cause is rooted in the concept of choice. Companies buying computer systems should be able to purchase equipment from any supplier, plug it in and have it play without worrying about whether the parts will work together. Conformance to standards will enable all this to happen, the theory goes, benefiting acquirers of open systems technology by providing them with better products at better prices.

At the desktop, much of the industry's attention has been focused on whether OS/2 will make it as a successor to DOS. With nearly 40 million installations, DOS is an entrenched operating system and, as IBM and Microsoft Corp. have learned, it is no simple matter to migrate such a base to the next-generation system, OS/2.

But the real contest for the hearts and minds—not to mention pocketbooks—of PC users may not be simply the answer to the question of whether OS/2 will succeed DOS. There is another choice that many can make. And that choice is UNIX.

Providing that choice to thousands of users is The Santa Cruz Operation Inc.'s UNIX, with its conformance to four important industry standards—the AT&T System V Interface Definition, the IEEE Portable Operating System Interface for UNIX (POSIX) specification, the X/Open Portability Guide Edition 3 (XPG3) and the federal government's C2 security standard. UNIX is a viable alternative to OS/2, but the extent of the viability depends on what you're doing and for how many.

SCO: UNIX for the desktop.

As Santa Cruz executive vice president Doug Michels says in our cover story this issue, "UNIX Punch For PCs," page 26, "Sure, there's a lot of desktop systems out there that don't need UNIX. An MIS manager that wants to deploy 100 PCs for word processing will choose Windows. But those mission-critical applications that run on network devices that communicate with corporate information systems will run UNIX."

And that's the critical point in the emerging world of open systems and choice. It's not enough to have lots of choices. As an IS professional, you must first know what your organization wants to accomplish with its information systems. Then you can decide what system will best meet the objective.

IBM's Mainframe Strategy In Perspective

This year, our now traditional annual report on IBM targets Big Blue's mainframe strategy. Exactly what that strategy is—and what IBM has either provided or promised in the way of products to back it up—couldn't be a more timely area for examination, following the recent introduction of the System/390 mainframe family and considering what IBM has said about the emerging client/server model of computing.

What IBM is trying to do, of course, is reposition the perception of the mainframe from centralized host to large-network server.

For an analysis of how IBM is doing in this regard, turn to our Special Report, "Can Big Blue Reposition Big Iron?" page 54. Written by senior writer Jeff Moad and New England bureau manager Ted Bunker, this report is must reading for any company that already has millions invested in mainframes. And that means you.

David R. Brousell, Editor

Coming Next Issue

- A price/performance breakthrough in [illegible]
- The winners of the Products Of The Year [illegible]
- How to take control of your PC assets
- Inside IBM's System [illegible]

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Vendors Cast Mini In A New Role

Forecasting a gloomy future for stand-alone midrange computers based on proprietary operating systems, vendors are dressing up minis as open systems servers and hoping for the best.

BY TED BUNKER

Kenneth H. Olsen, the plain-spoken founder and president of Digital Equipment Corp., stood last fall before a hall packed with anxious investors and made his pitch:

"Minicomputers are not obsolete," he said, and defined a mini as a computer that works fast and doesn't cost a lot. "By any definition of a minicomputer, a workstation is a minicomputer," Olsen said. "If anything is a minicomputer, a server is a minicomputer."

That it has become necessary to delineate the distinguishing characteristics of minicomputers—especially with such flexible definitions—is a symptom of what ails this industry. Growth has slowed to a crawl in the non-UNIX midrange market. Users are demanding open systems, at least as a future option, say analysts and industry observers. And users apparently find the low cost of networked microcomputer-based file servers an attractive alternative to minicomputer solutions. These increasingly powerful microcomputers, when configured as servers, are eating into the low end of the midrange market, while high-powered UNIX-based systems are already nibbling away at the bread-and-butter business of companies like Digital.

A Formidable Competitor

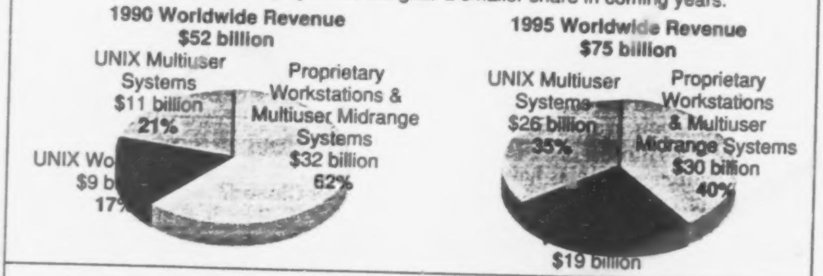
Beset by stagnant or falling sales and minimal profits or staggering losses, the strongest of the traditional minicomputer vendors are racing to reposition their hardware to compete with microcomputers and UNIX-based systems. Struggling to return to the prosperity of past years, these proprietary midrange vendors are adding open systems interfaces to their systems. They are also switching to reduced instruction set computing (RISC) architecture to boost price/performance. And they are pushing customers to accept minis as network, file and database servers.

Adding to the pressures on companies like Digital, Data General Corp. and Hewlett-Packard Co. is IBM's reemergence as a serious competitor in the midrange market. Since 1988, IBM's AS/400 has grown into a $12 billion-plus business, catapulting the Armonk, N.Y., computer giant into the midrange market lead. But most AS/400 units shipped have replaced older IBM equipment, primarily System 3X machines. As analyst Peter Schay of the Gartner Group Inc. points out, that's a zero-growth business.

Robert J. LaBant, IBM vice president and general manager of the Application Business Systems division, is quick to say that AS/400 wins are not all System 3X

Proprietary Midrange Market Fades Slowly...

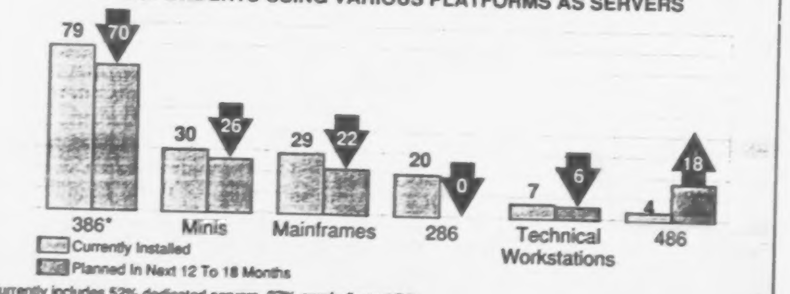
Although the worldwide market for midrange systems continues to grow, proprietary systems will grab a smaller share in coming years.



As Computer Users Look To 486-Based Servers

The use of 486-based computers as servers is expected to soar in the next 12 to 18 months.

% RESPONDENTS USING VARIOUS PLATFORMS AS SERVERS



*Currently includes 52% dedicated servers, 27% nondedicated PCs. Planned use includes 47% dedicated servers, 23% nondedicated PCs.

Source: Business Research Group

replacements: a sizable portion of total AS/400 sales are "win backs," he says, in which the AS/400 is replacing a box made by some other vendor. And, he says, most IBM System 3Xs replaced by AS/400s are not retired, only moved to a different part of the customer's operation. Eventually, he expects those systems to be replaced by AS/400s, too.

LaBant also says 75% of the AS/400s installed thus far have personal computers attached. This is a good precedent for IBM, says LaBant, because in the future, "our focus will be on making the AS/400 a database server."

Both IBM and Digital are expected to prosper as midrange systems vendors during the 1990s, but for different reasons. Digital has announced plans to add open systems interfaces to its proprietary VMS operating system. This move, plus the VAX's top-rated connectivity characteristics, will help the Maynard, Mass., company position its VAX minis as open systems servers. Meanwhile, the AS/400 leaves unchallenged Digital's dominance in technical markets for multiuser midrange systems.

But IBM's midrange system has been winning greater and greater acceptance among commercial users, and the company is integrating the AS/400 line with its various enterprisewide computing architectures. Furthermore, by replacing System 3Xs and adding to existing AS/400 capacity, IBM will buttress its midrange business for years to come.

The Case Of The Disappearing Mini

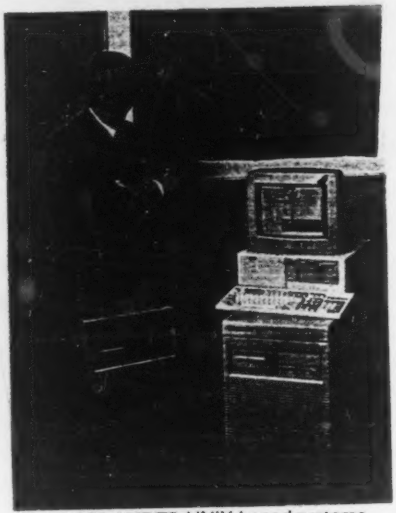
Ultimately, however, even IBM may have to face what other makers of proprietary midrange systems have recognized: the proprietary midrange system is weakening, pummeled by low-cost, networked PC-based file servers.

LaBant and other vendors counter that general-purpose midrange systems make better, more flexible LAN servers than low-cost micros based on Intel Corp.'s 80386 and 80486 microprocessors. The advantages of higher throughput, multiuser functionality and better transaction-processing capability outweigh price differences that can exceed 10 to one, vendors argue.

Some users are buying that argument. But many are not.

"The midrange machine is really dead," says Jerry Ely. Ely, director of information systems at Merrill Lynch & Co. Inc. in New York City, believes "the word *minicomputer* is going to disappear."

Still, for all the handwringing about the weakening mini market, survey data indicate the move away from the proprietary mini may be taking place at a much slower rate than the accompanying hype would have you believe. In one survey of 100 IS managers at *Fortune* 1,000-sized companies, the market research arm of Cahners Publishing Co., Business Research Group, asked respondents if they thought microcomputers would replace minicomputers in their organizations. Fifty-nine percent of the respondents said no. And 55% said they didn't believe micros could duplicate mini functions.


HP'S ROELANDTS: UNIX-based systems are outselling the HP 3000 proprietary models.

In another survey, Boston-based securities firm Cowen & Co. asked DATAMATION readers whether they would base new applications on proprietary operating systems or on UNIX. Of 4,062 total respondents, 75% of IBM proprietary systems users, 69% of Digital users and 56% of HP users said they would stick with proprietary systems.

Open Or Closed?

At IBM, LaBant is aware of this quiet user loyalty to proprietary systems. The AS/400 chief says he sees no great urgency to add open systems components, like X/Open Co. Ltd.'s Portable Operating System Interface For UNIX (POSIX), to OS/400. He says the lack of open-system features ranks among the least significant objections that potential AS/400 customers raise. But, despite LaBant's words, the company has outlined plans to add Open Systems Interconnect (OSI) protocols to OS/400. And a version of AIX, IBM's UNIX derivative, is being readied for the midrange line.

To some degree, IBM is straddling the fence—upon which Digital and HP also teeter—that separates the need to reassure users of proprietary technology that their investments are safe and the need to forge into the market for standards-based equipment and software. LaBant claims there is little midrange competition from either of IBM's microprocessor-based lines, the PS/2 and the RISC System/6000. For the time being at least, LaBant says, IBM's plans for the AS/400 center on extending the processing power of the system. Although attempting to characterize the AS/400 as a server, IBM is sticking to a traditional minicomputer approach more so than any other leading mini maker.

Digital is also adding power to its VAX line with a plan to reconfigure all future VAXs as RISC-based machines, says Bob Glorioso, vice president of information systems. In fact, Glorioso points out, much of the 9000 is already designed using a RISC architecture. Digital is banking on its latest VAX 9000 line to push into the realm of mainframe computing, to give VAX/VMS users more power without requiring a switch in vendors.

In the traditional midrange arena, Digital is positioning the VAX 6000 line as transaction-processing or production systems and as general-purpose servers.

At the same time, Digital is adding POSIX to its VMS operating system, which, Demmer says, should make it possible to run UNIX-based applications on VMS with little or no modification.

Hewlett-Packard has already moved both its proprietary HP 3000 and its HP/UX UNIX-based 9000 systems to a single, RISC hardware design—and the company is in the process of moving its workhorse HP 1000 real-time system to RISC, as well. Wim Roelandts, HP's vice president and general manager of the computer systems group, says the UNIX-based systems are outselling the HP 3000 proprietary models. Revenues generated by the HP 9000 rose 62% from 1989 to 1990, while those brought in by the 3000 grew by only 10% in that same period. Despite the precipitous growth of HP's UNIX-based line, Roelandts says, the battle for market share among UNIX vendors is not over: "[It hasn't] even started, as far as I'm concerned."

Will these strategies work? Gartner's Schay thinks Digital's proprietary systems will continue to hold a big piece of the midrange market because they function well as PC LAN servers. In his view, that's the key to success for midrange systems. He says IBM will continue to dominate the midrange market thanks not to the AS/400, which will "hold its own," but to its latest rising star, the RS/6000 line of RISC workstations and servers. As for other proprietary systems, he says: "All that stuff is fading." ▭

MARKET INSIGHTS

AN ANALYSIS OF ECONOMIC TRENDS

Been Down So Long It Looks Like Up

BY MADELINE FRANCHI
Cahners Economics

The DATAMATION Information Systems Performance Indicator (ISPI) hasn't veered very far from its expected downward course. Taking into account the latest data from September 1990, the indicator had fallen to 97.96—down almost a point from August's 98.8 reading. The computer stock price index, which dropped from 168.7 in August to 162.7 in September, was the main factor pulling the indicator down.

Manufacturers of IS equipment continued to reduce inventories in September, which also kept the indicator heading down. Inventories fell from year-ago levels for five consecutive months through September, a trend surpassed only twice during the past 20 years—during the 1976 general economic recession and the 1986 computer industry slump.

But on the up side, new orders for IS equipment helped shore up the ISPI. September new orders recovered strongly from the one-month setback in August and advanced 1.5% over the level recorded in September 1989. In particular, orders for computers and office equipment rose by 26% from August to September and were almost 3% higher than they were in August 1989.

We expect the ISPI to rise, albeit weakly, through the early part of this year; the indicator will most likely have reached its low point in late 1990. ▭

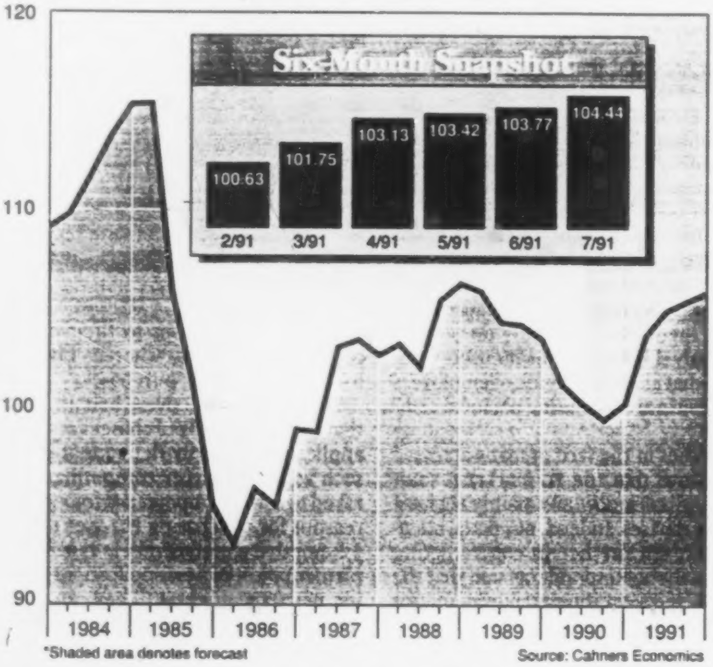
Methodology

The DATAMATION Information Systems Performance Indicator tracks the economic health of the IS industry. Cahners Economics developed this indicator, which is based on weighted moving growth rates for five statistics: (1) IS inventory, (2) new IS orders, (3) average weekly hours of computer industry employees, (4) Standard and Poor's Computer Systems Stock Price Index and (5) contracts and orders for plant and equipment.

For more information on Cahners Economics's forecasting services, including seminars, newsletters and database diskettes, phone Dan Buchan at (617)-630-2105, fax him at (617)-630-2100, or write to him at Cahners Economics, 275 Washington Street, Newton, MA 02158.

The IS Performance Indicator

For IS, 1991 will be the year to watch.



*Shaded area denotes forecast

Source: Cahners Economics

	Sept. 1990	August 1990	% Change 8/90-9/90	Sept. 1989	% Change 1989/1990
■ **Information-Processing Equipment**					
Shipments (SA, $ billions)	10.03	9.81	2.2	9.62	4.2
New Orders (SA, $ billions)	10.43	9.41	10.8	10.27	1.5
Unfilled Orders (SA, $ billions)	29.20	28.80	1.4	28.44	2.7
Inventory (SA, $ billions)	21.40	21.40	0.0	21.98	-2.7
■ **Computer Production Workers**					
Employment (NSA, thousands)	272.9	273.3	-0.1	290.7	-6.1
Average Weekly Hours (monthly avg.)	42.2	41.4	1.9	42.0	0.5
■ **Stock Index**					
S&P's Computer Systems Stock Price Index	162.7	168.7	-3.6	193.1	-15.7
■ **Contracts & Orders**					
New Plant & Equipment (SA, $ billions)	42.24	39.4	7.2	41.61	1.5

SA= seasonally adjusted;
NSA= not seasonally adjusted

Sources: U.S. Commerce Dept. and Standard & Poor's; forecasts: Cahners Economics

MARKET INSIGHTS

A SURVEY OF TECHNOLOGY TRENDS

Corporate PC Sales Will Stay Strong

BY WARREN CHILDS
Business Research Group

Despite vendors' fear that the boom in PC sales ended long ago, the latest survey of the DATAMATION Technology Implementation Panel reveals that corporate America's need for personal computers continues to grow.

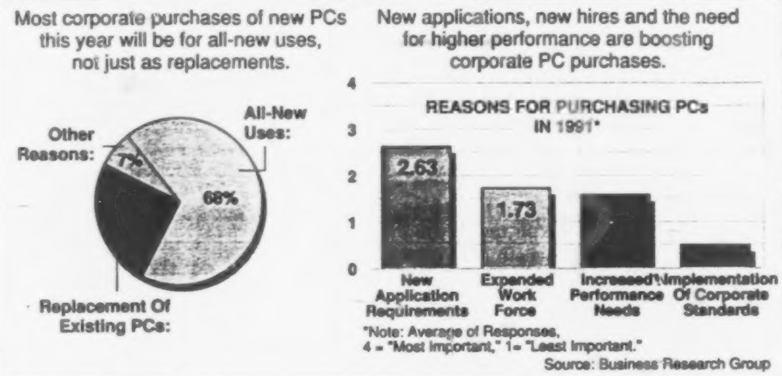
When asked to indicate what percentage of their professional, office and administrative staff currently have PCs, less than half of our panel members said 50% or more. A strong 54% said more than half of their staffs currently do not use PCs. Only 11% of panel members reported that all, or nearly all, of employees at their sites are now using personal computers.

This flies in the face of many analysts' contentions that the PC market is saturated and sales now are mainly replacement purchases. Indeed, our panel members go even further in contradicting these analysts. Respondents said that the majority (68%) of their PC purchases this year will be additions to their existing complement of PCs, whereas only 25% will be replacement purchases.

Panels members overwhelmingly said that the additional purchases are for new applications heavily dependent on PCs, such as client/server computing. When asked to rank in importance four possible reasons for purchasing PCs over the next 12 months, panel members ranked "implementation of new applications requiring new PCs" highest. They ranked the need to "provide PCs for an expanding work force" and the need to "replace PCs with higher performance ones to increase productivity" closely as second and third. "Replacing PCs to comply with corporate standards" was ranked a distant fourth. ▭

For more information, call Nancy Finn at (617)-964-6204, fax her at (617)-558-4402 or write to her at Business Research Group, 275 Washington Street, Newton, MA 02158.

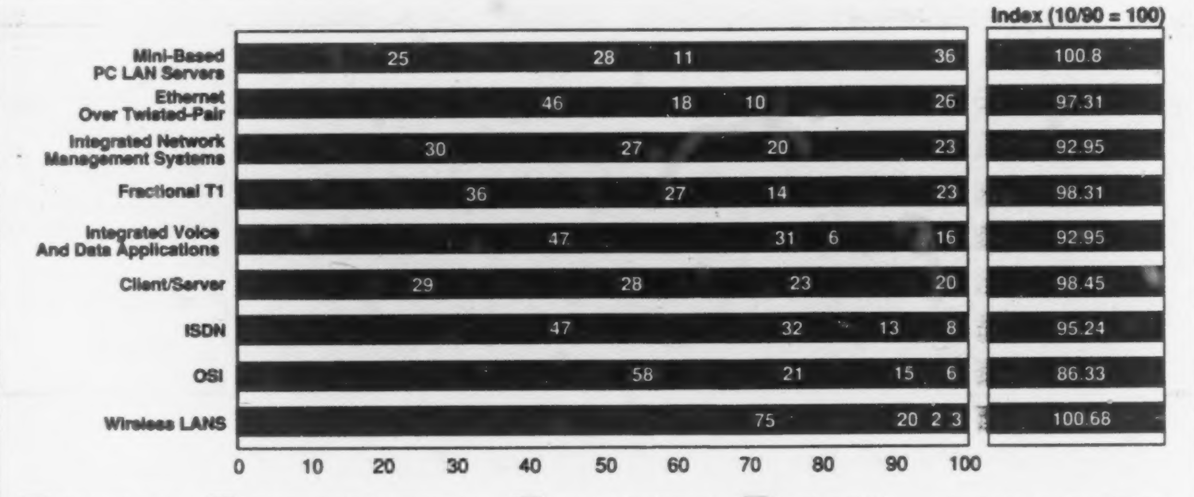
Growing For Growth's Sake



*Note: Average of Responses, 4 = "Most Important," 1= "Least Important."

Source: Business Research Group

DATAMATION's Technology Implementation Index: Networks/Communications



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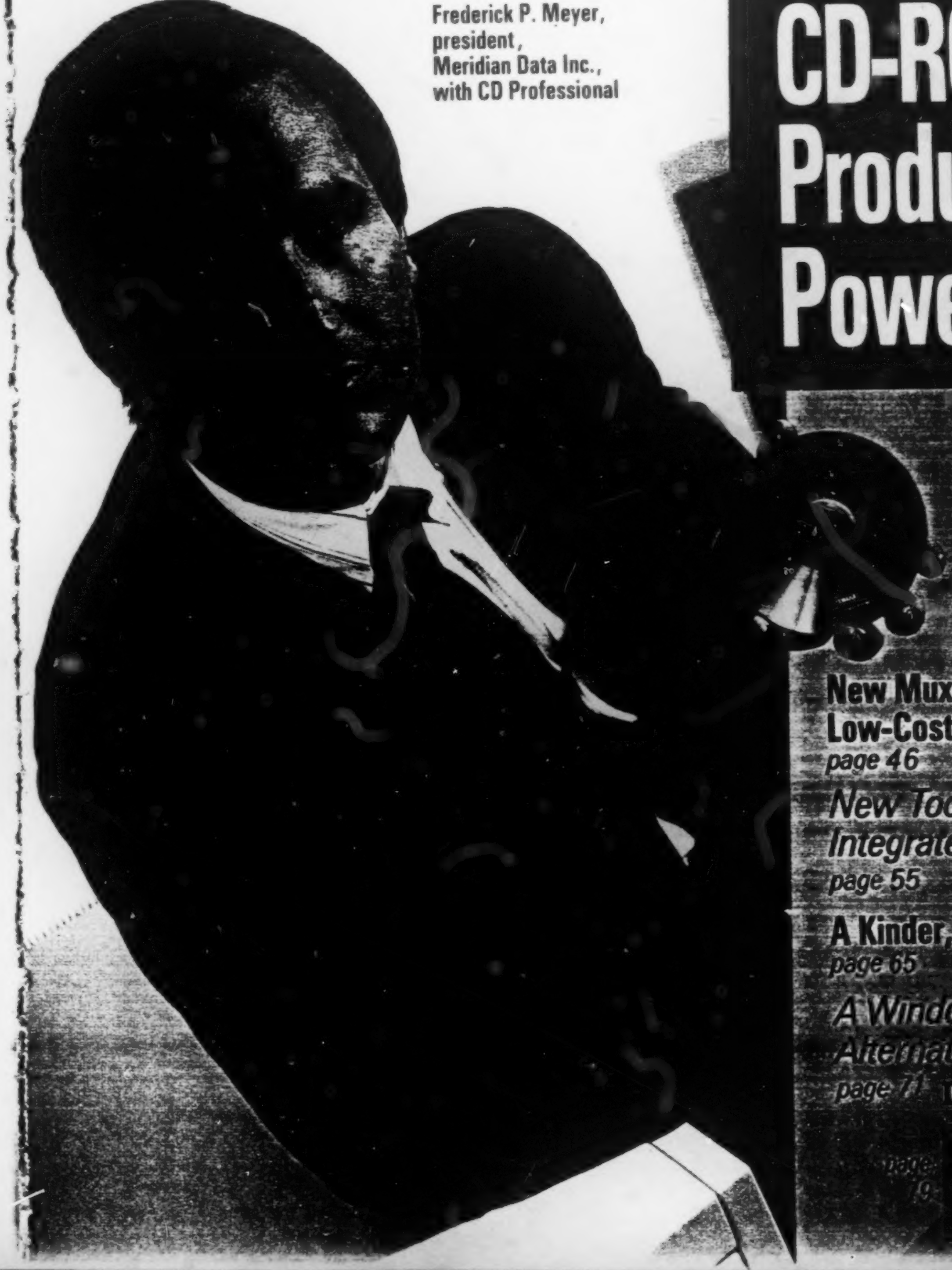

Frederick P. Meyer,
president,
Meridian Data Inc.,
with CD Professional

CD-ROM Production Power!

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Take Control Of Your PC Assets
page 33

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New Muxes Deliver Low-Cost Data
page 46

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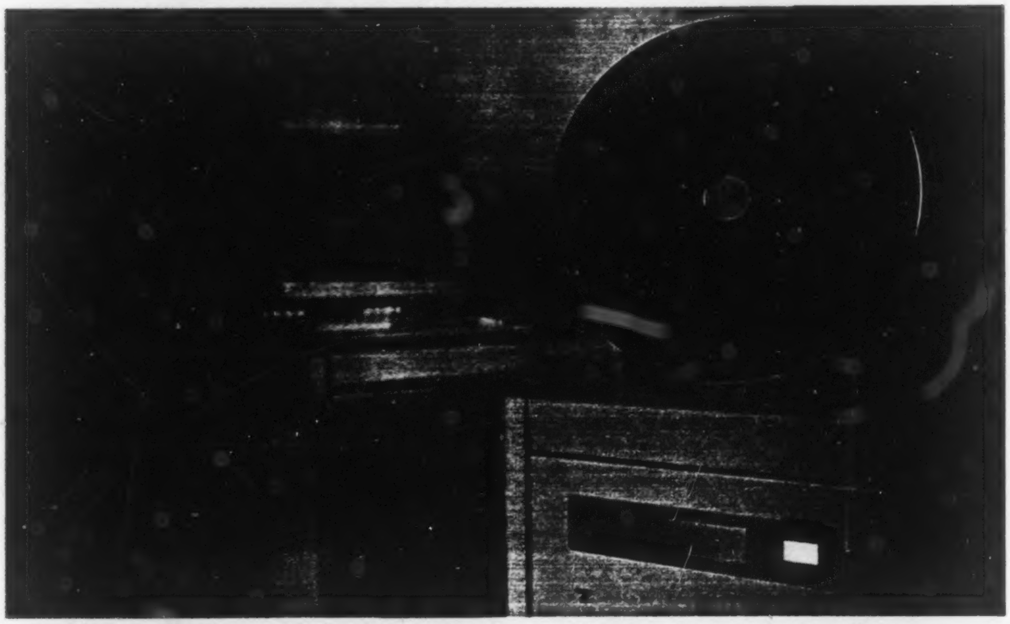

Using CD Professional, users can bypass the expensive outside mastering process altogether.

COVER STORY

PCs & WORKSTATIONS

CD-ROM Production Power! 26

BY TOM McCUSKER Producing a CD-ROM application was once so expensive that only huge projects were justified. But Meridian Data's CD-ROM Professional potentially lowers the cost by bringing CD-ROM production in house.

Cover photography by David Toerge/Black Star

SPECIAL REPORT

CONTEST WINNERS

Products Of The Year 79

BY MIKE RICCIUTI In the October 15, 1990 issue, DATAMATION asked IS professionals to vote for the year's most outstanding new products from our roundup of more than 100 innovative industry offerings.

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FEATURE

A Windows Alternative 71

BY JEFF MOAD Geos, a Windows alternative for 8088- and 80286-based PCs, interests users, but it does have one drawback: too few applications.

GeoWorks's Dougherty says new applications under Geos, such as a database and spreadsheet, will shape the future.

FEATURES

PCs & WORKSTATIONS

ASSET MANAGEMENT

Take Control Of Your PC Assets 33

BY BOB FRANCIS Today's IS managers are responsible for billions of dollars worth of equipment and software. But how many managers really know where and what their assets are? Here are several ways to find out.

Coopers & Lybrand's Rood found himself in charge of a computer hodgepodge.

INTEROPERABILITY

PC Software Moves Upscale 37

BY GREGG KEIZER A growing number of companies are successfully running their favorite PC software packages on minis and mainframes. It's often cheap and easy to do, but you can't always get the latest version for the big iron.

NETWORKS

WIRELESS

Wireless LANs Cut Cabling Hassles 43

BY TED BUNKER Major vendors are now marketing cable-free local area networks that make adds, moves and deletes a trivial matter. Speeds are now competitive with cabled LANs, but you pay for convenience.

NETWORKS

MULTIPLEXERS

New Muxes Deliver Low-Cost Data 46

BY TOM McCUSKER Network access multiplexers fill a need for single-point T1 connections— and at a very low entry cost. Now large equipment suppliers are offering them.

SOFTWARE

OFFICE AUTOMATION

New Tools To Integrate The Office 55

BY JOHN KADOR Management wants to automate the office so much it hurts. And guess what? IS managers now have their choice of a bevy of new office systems that may, at long last, make the office floor hum like the factory floor.

SYSTEMVIEW

Inside IBM's SystemView 62

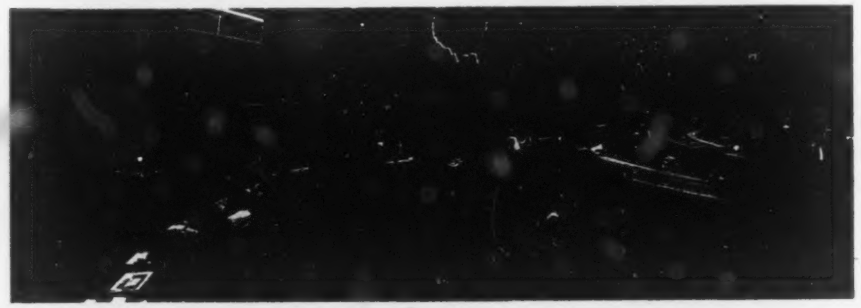
BY LEILA DAVIS IBM touts SystemView as the solution to all your system management problems. The Big Question: When will it all happen?

SYSTEMS

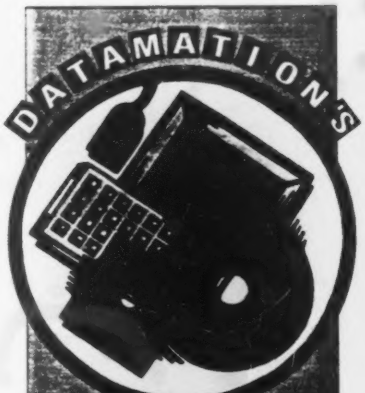
OUTSOURCING

A Kinder, Gentler EDS? 65

BY JEFF MOAD Critics describe outsourcing vendor EDS as a shark—a company with killer instincts and big teeth. The company is trying to soften its image. But it's still cruising for prey, and some IS managers are nervous.



EDS's Legacy Park in Plano, Texas, has everything under control, page 65.



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Peripherals
Hewlett-Packard's LaserJet III

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INSIDE DATAMATION

CD-ROM Power For The Masses

Just a few years ago, the idea of having your own compact disc, read only memory production facility was a dream. The cost of gathering data, reformatting it for use on a CD-ROM and going to an outside mastering facility to produce a master disc all but prohibited many companies from using this efficient storage medium.

But now this dream is becoming a reality, thanks in large part to advances in price and performance. The subjects of our cover story this issue, Meridian Data Inc. and its CD Professional CD-ROM system, are, of course, examples of a company and a product that have been in the forefront of helping to achieve this breakthrough.

Tom McCusker, our Los Angeles bureau manager and author of "CD-ROM Production Power!," page 26, sums up the appeal of a system like the CD Professional. "Meridian's approach of using PCs for all data preparation purposes offers would-be CD-ROM publishers a number of possible savings. Some companies today, for example, surrender control of the CD-ROM data preparation stage to third parties or choose to format data on more expensive mainframes or minicomputers. In the case of the CD Professional, even the actual cutting of a CD-ROM—an expensive process normally managed by the same huge factories that churn out compact discs for your stereo—is handled by . . . a desktop peripheral."

McCUSKER: Plays up CD-ROM appeal.

The appeal of this technology is also becoming apparent to IS organizations. For example, Complete Health of Alabama Inc., a Birmingham health insurance company, uses the CD Professional to record scores of gigabytes of health claims information and link the discs to a server on the company's local area networks. And computer companies, such as Apple Computer Inc., IBM and Sun Microsystems Inc. are using such systems to disseminate software development information to customers.

Now that the cost of entry for CD-ROM production has been lowered, the technology will spread to more and more companies and more and more people. It's another example of how that critical growth driver—price/performance—keeps us all moving ahead.

And the Winner Is . . .

What could be a more rewarding testament to a company's product than to have the people who actually use it vote it their favorite? We really can't think of any better way to identify the products and technologies of significance to IS managers. And so, in this issue, we announce the results of our 1990 Products Of The Year Contest, page 79, chosen by the members of the IS community.

The overall winner of the contest, the ballot for which ran in our October 15, 1990 issue, is Novell Inc.'s NetWare 386 version 3.1., which also won in the Networks category of the contest. In the other categories, Compaq Computer Corp. took top PCs & Workstation honors with its SystemPRO, Microsoft Corp.'s Windows 3.0 was the Software winner, Digital Equipment Corp.'s VAX 9000 prevailed in Systems and Hewlett-Packard Co.'s LaserJet III was voted tops in Peripherals.

The ballot for our 1991 contest will be in the September 1 issue. So, start your engines now.

David R. Brousell, Editor

Coming Next Issue:

- How Auspex is carving a UNIX superserver niche
- Portable PCs at work
- A look at rewritable optical drives for PCs

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MARKET INSIGHTS

AN ANALYSIS OF ECONOMIC TRENDS

Health Services Grow, Others Go Slow

BY MADELINE FRANCHI
Cahners Economics

After a decade of rapid expansion in the 1980s, growth in the services sector slowed in 1990, and slower growth will continue this year. The services sector is the economy's most intensive user of information services.

After adjusting for inflation, we expect consumer spending on all services to increase only slightly in 1991, by a mere 0.7%. Compare that with last year's modestly healthy 2.8% increase.

The services sector is additionally important to the IS industry because of its impact on the rest of the nation's economy; services account for more than three-quarters of all nonagricultural employment in the economy.

Within the direct services segment, by far the fastest growing area remains health care services. In 1991, consumers will spend an estimated $530 billion on health care services, an increase of over 10% from the 1990 total of $480 billion. A substantial part of this increase will result from rising costs of medical care, not from increases in demand.

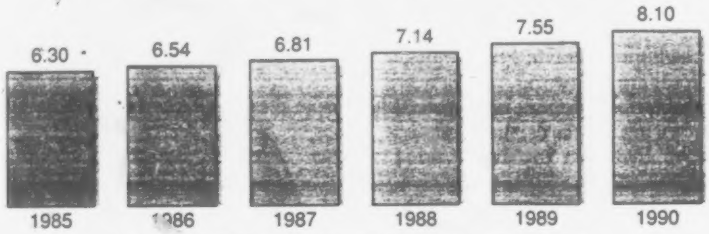
But, consumer spending for health care will still rise 4.3% in 1991, if you factor out inflation. Consumers are accustomed to a high level of medical services, and most people must continue to pay for health care despite an economic slowdown. The rise in the median age of the U.S. population will mean higher expenditures for health care, too.

The added need for health care professionals has meant a steady rise in their numbers. Last year, average annual employment in health services totaled almost 8.1 million, up from 7.1 million just two years earlier. Furthermore, growth in health care employment is accelerating, jumping up from 3% in 1985 to just over 7% in 1990. ▭

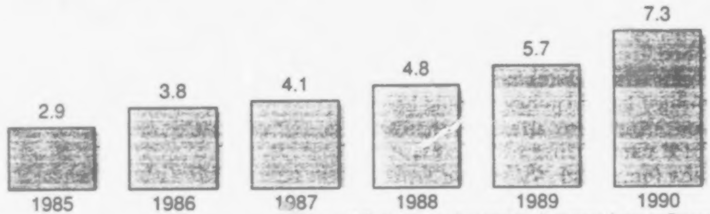
For more information on Cahners Economics's forecasting services, including seminars, newsletters and database diskettes, call Dan Buchan at (617)-630-2105, fax him at (617)-630-2100 or write to him at Cahners Economics, 275 Washington St., Newton, MA 02158.

Healthy Growth For Health Services Employment

Millions of persons employed in health services (annual average)



Annual % Change In Health Services Employment



Source: U.S. Commerce Department; forecasts: Cahners Economics

The Economy At A Glance

U.S. Economy: Macroeconomic And Industrial Indicators

	Actual		Forecast (Annual % Growth)		
	Q2/90	Q3/90	1990	1991	1992
Gross National Product	0.4	1.7	1.1	0.9	3.1
Business Investment In Equipment	-3.3	10.1	2.3	2.4	4.6
Government Spending	6.2	0.6	2.4	0.5	0.8
Consumer Spending	0.2	3.2	1.2	0.6	2.5
Exports	-5.0	4.3	5.3	3.1	5.4
Imports	0.7	4.3	3.3	2.2	2.7

All calculations are % change in 1982 dollars; quarterly figures are seasonally adjusted annual rates.

	Oct.	Sept.	% Change 10/90-9/90	Oct. 1989	% Change 1990-1989
Manufacturing Production (1)					
Process Industries Total	109.4	110.1	-0.6	108.2	1.1
Chemicals	111.1	110.6	0.5	109.4	1.6
Petroleum	109.3	110.9	-1.4	106.9	2.2
OEM Total	114.2	115.5	-1.1	110.0	3.8
Computers & Peripherals	152.6	153.6	-0.7	132.8	14.9
Communication Equipment	110.1	111.1	-0.9	107.1	2.8
Transportation Equipment	109.2	111.7	-2.2	102.1	7.0
Services Employment (2)					
Finance, Insurance, Real Estate	6.834	6.862	-0.4	6.737	1.4
Health Care	8.286	8.234	0.6	7.685	7.8
Computer & Data Processing	0.811	0.808	0.3	0.764	6.1
Transportation/Utilities	5.928	5.914	0.2	5.720	3.6
Retail Trade	19.804	19.872	-0.3	19.688	0.6
Wholesale Trade	6.374	6.379	-0.1	6.[illegible]33	0.6
Government	18.568	18.024	3.0	18.113	2.5

(1) Index 1978=100, seasonally adjusted
(2) Millions of persons, not seasonally adjusted

Source: Commerce Dept. and Cahners Economics

MARKET INSIGHTS

A SURVEY OF TECHNOLOGY TRENDS

IBMers Are Big On Token Ring

BY WARREN CHILDS
Business Research Group

Despite widespread use of Ethernet wiring for local area networks, and despite the introduction of more economical Ethernet wiring standards, the latest survey of the DATAMATION Technology Panel shows that use of Token Ring LANs will increase at a faster pace than Ethernet in the near future—especially in large IBM shops.

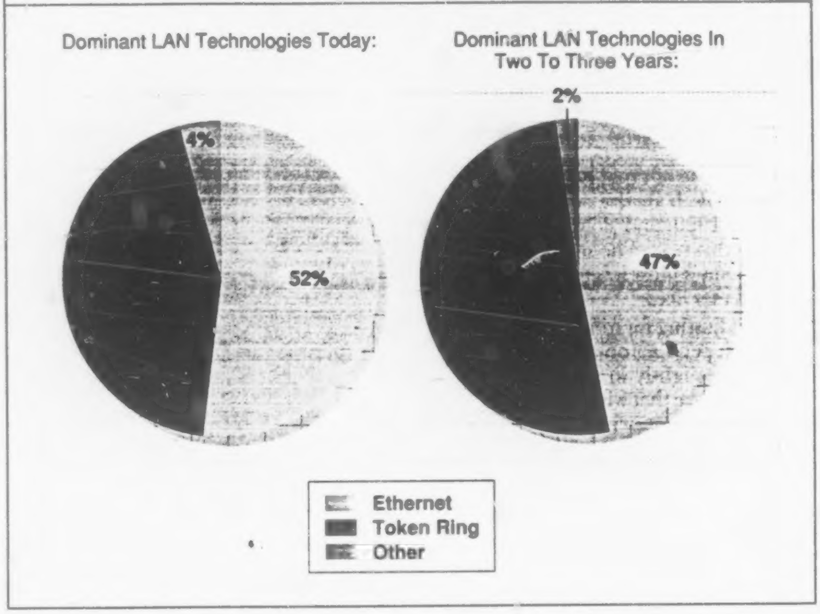
When asked to name the dominant LAN technology at their locations, 52% of our panel members named Ethernet, 44% named Token Ring and 4% named other technologies. But when asked to predict which LAN technology would be dominant at their sites in two to three years, 51% named Token Ring as the LAN of the future and 47% named Ethernet.

And no wonder, since IBM is now the predominant vendor of Token Ring LANs. As a result, Token Ring is growing at a heady pace in large IBM-based IS shops—many of which are represented in our Technology Panel's membership, which is made up of IS pros at sites with 1,000 or more employees and at least one midrange computer up and running.

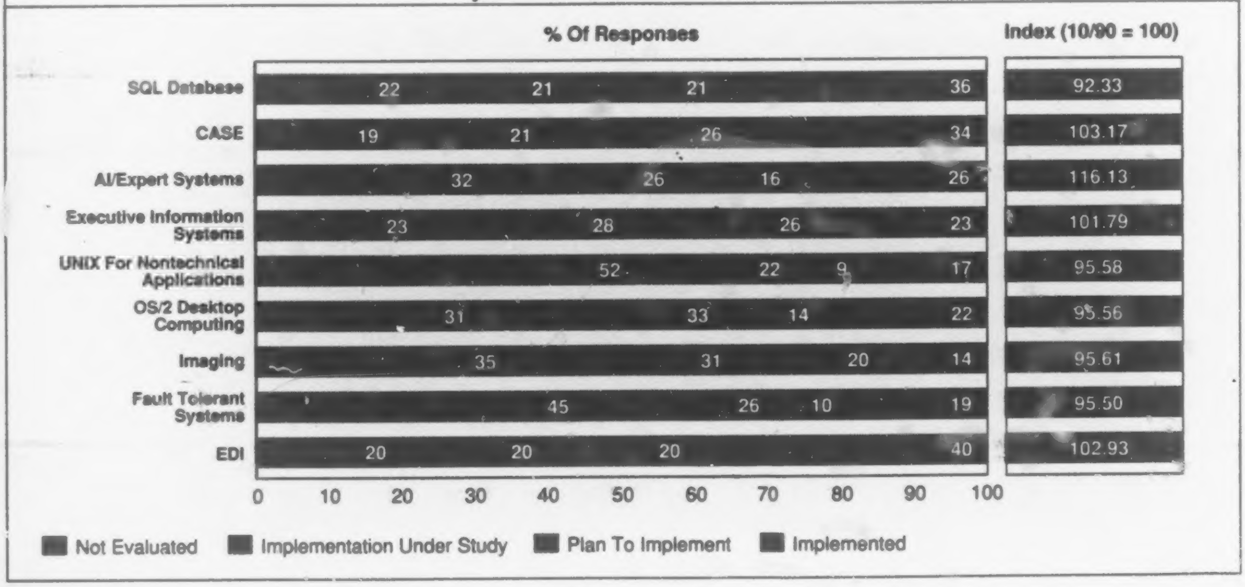
One caveat in reading the panel's data: most analysts expect Ethernet to continue to lead Token Ring through the middle of the decade at smaller IS shops. ▭

For more information, call Nancy Finn at (617)-964-6204, fax her at (617)-558-4402 or write to her at Business Research Group, 275 Washington Street, Newton, MA 02158.

Only A Token Shift?



DATAMATION's Technology Implementation Index: Systems And Software



SPECIAL REPORT: PC Portables Join The Executive Ranks

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UNIX Server CLOUT!

page 22

Larry Boucher, president, Auspex Systems Inc., with the NS 5000

Rewritable Optical Still Not In Overdrive *page 35*

Curing The LAN Support Blues page 41

Stop Net Faults Before They Stop You *page 44*

Plug Your Customers In page 49

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A PC Gateway For AS/400s page 57

Mark

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PC Accounting Software

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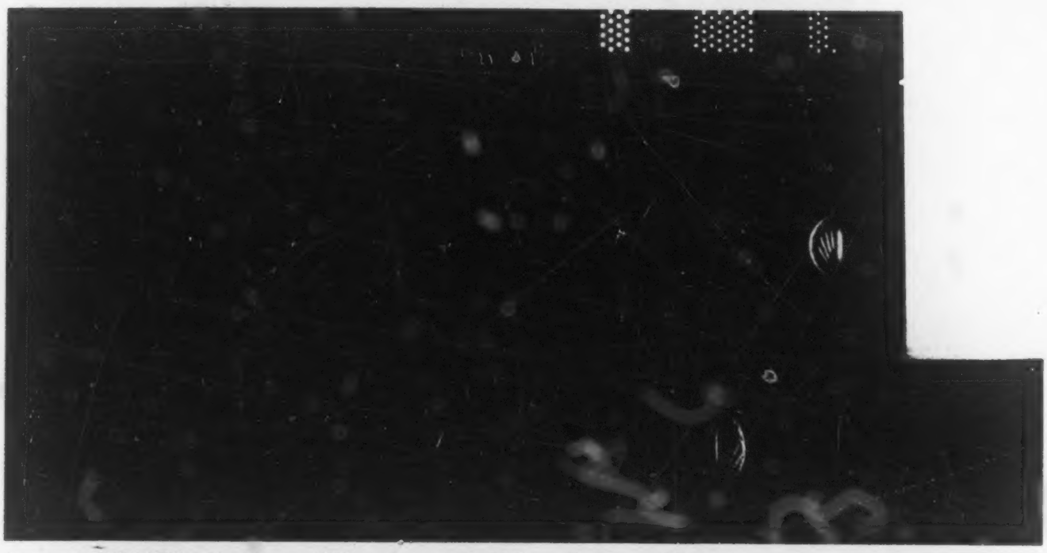

Auspex's NS 5000 is the shape of things to come in high-performance file servers.

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UNIX Server Clout! 22

BY DAVID STAMPS Auspex Systems is smack in the middle of the growing market for superservers that operate as foundations for workstation networks. Some Sun users, faced with I/O bottlenecks and sluggish network performance, are turning to Auspex for relief.

Cover photography by Christopher Springman

SPECIAL REPORT

MS-DOS PORTABLES

PC Portables Join The Executive Ranks 29

BY BOB FRANCIS, JOHN McMULLEN AND JEFF MOAD Portables are fast becoming indispensable. Pen-based systems are coming, and speech recognition may be just a few years away.

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A PC Gateway For AS/400s 57

BY TOM McCUSKER Now you can connect four times more PCs to an AS/400 through one server with Bluelynx.

Micro-Integration's Filion answers the call for multiple gateway support.

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Rewritable Optical Still Not In Overdrive 35

BY JOHN McMULLEN Two years ago, pundits predicted rewritable optical drives would send hard disks packing. That hasn't happened, but several new drives and a little bit of help from Big Blue may yet jump start the technology.

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Curing The LAN Support Blues 41

BY SUSAN KERR Do you have your hands full trying to maintain and manage multiple local area networks while handholding end users? Good news. An industry is springing up to do it for you.

DISASTER AVOIDANCE

Stop Net Faults Before They Stop You 44

BY IVAN FRISCH Equipment and software often interact in unanticipated ways to bring down a network. This major problem is only beginning to be recognized, and users need the tools to tackle it.

SOFTWARE

CLIENT/SERVER

Plug Your Customers In 49

BY MARK SCHLACK A major shipping line lets customers connect to its distributed wide area workstation network, giving them instant service for up-to-the-minute information on the status of cargo, billing and booking.

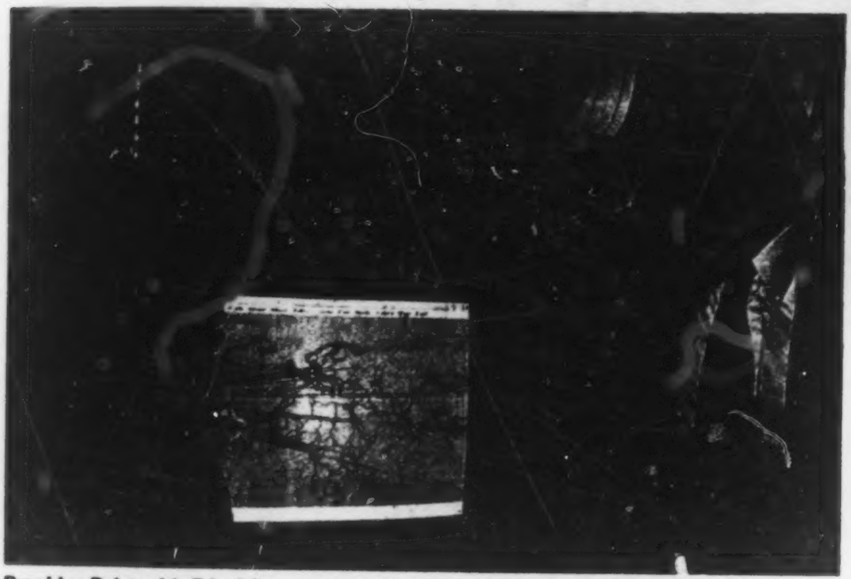
SYSTEMS

OLTP

UNIX Goes On Line 53

BY JEFF MOAD UNIX promises low-cost distributed transaction processing. Some industrial-strength monitors are coming to market now, but standards have not yet been pinned down. Do you want to make the gamble?

Burlington Coat's Prince: A pioneer of UNIX TP monitors.



Brooklyn Polytech's Frisch keeps a watchful eye on networking traffic, page 44

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MARKET INSIGHTS

A SURVEY OF TECHNOLOGY TRENDS

Everybody Wants A Piece Of T1

BY WARREN CHILDS
Business Research Group

The most recent survey of the DATAMATION Technology Panel shows a strong and growing interest in fractional T1 services. Twenty-one percent of panel members are currently using T1 services, and an additional 15% plan to implement them.

The introduction of fractional T1 services makes 64-kilobit-per-second transmission capacity available for wide area network applications without leasing full T1 capacity. Despite the fact that T1 costs have dropped more than 50% over the last three years, many IS managers still can't justify the cost of full T1 pipes in view of their data communications requirements. Typical data communication applications require speeds of 19.2Kbps or less, and switched 56Kbps services are available for higher speed needs.

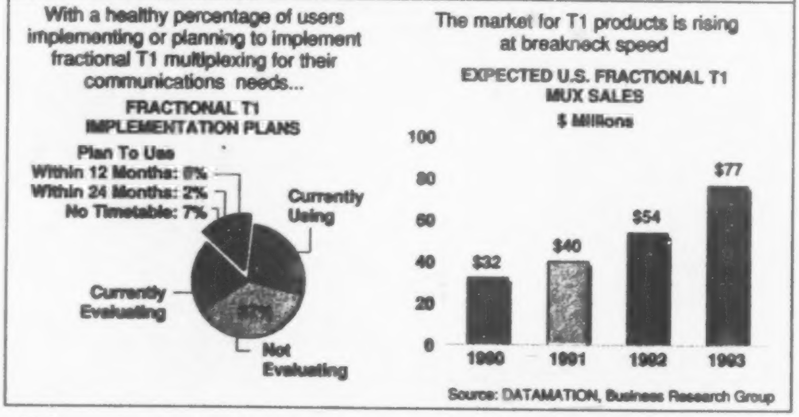
However, IS managers, expecting growth in distributed client/server and peer-to-peer processing applications, are out in search of access to greater bandwidth capacity. Fractional T1 gives them just that at a fraction of full T1's cost (pun intended).

As the use of fractional T1 lines grows, equipment vendors will begin to see the need for more equipment offering fractional capabilities. The market for multiplexers equipped for fractional T1 is projected to more than double from $32 million in 1990 to $77 million in 1993.

Eventually, improvements in fast packet technologies like frame relay will make their access more widely available and will take some of the steam out of fractional T1 service growth. Fast packet switching will have the added advantage of usage-based pricing, making it especially attractive to sites where wide bandwidth is needed only sporadically.

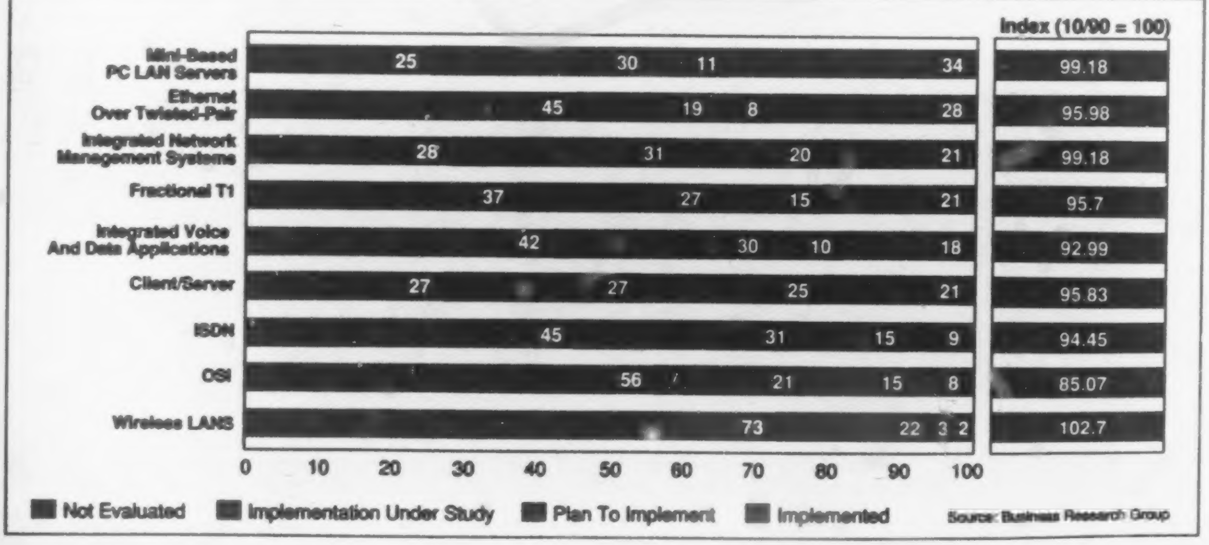
For more information, call Nancy Finn at (617)-964-6204, fax her at (617)-558-4402 or write to her at the Business Research Group, 275 Washington Street, Newton, MA 02158.

Hot New Technology: Fractional T1



Source: DATAMATION, Business Research Group

DATAMATION's Technology Implementation Index: Networks/Communications



Source: Business Research Group

SPECIAL REPORT: DEC's Ambitious Software Strategy *page 66*

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MARCH 15, 1991

J. Presper Eckert, inventor, with the UNIVAC I

40 Years Of Computing

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A Retrospective With:

Carl Reynolds,
Gordon Bell, Gene Amdahl,
Thomas Watson Jr.,
Fred Brooks, John Opel,
Robert Metcalfe,
Dan Bricklin, Rod Canion,
Alan Kay, John Armstrong,
Bernardo Huberman
and others

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A Novell Use For Minis *page 83*

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What Hath He Wrought? 30

BY DAVID R. BROUSELL
An interview with Dr. J. Presper Eckert, the coinventor of the UNIVAC I and the world's first electronic digital computer.

Cover shows Eckert in the late 1940s and today; photography by Eugene Mopsik.

Where it all began: Eckert outside U. of Penn.'s Moore School.

40 Years On The Frontier 34

BY LINDA RUNYAN Fasten your seat belts, and hang on tight. You're about to take a trip through 40 years of commercial computing. In this special section, DATAMATION celebrates the people and the technologies that created one of the world's most dynamic industries. It all started with the shipment of Remington Rand Inc.'s UNIVAC I to the U.S. Census Bureau 40 years ago this month.

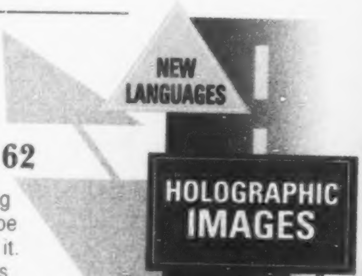
Trivia Contest 59

BY ANDREA OVANS AND CHRIS STAITI After spending weeks in our dusty, ill-lit storerooms poring over back issues of DATAMATION, we have come up with what we believe are a baker's dozen of the most formidably trivial questions we could find, three for each decade.

40 YEARS OF COMPUTING

Miles To Go 62

BY JEFF MOAD What will be coming up in the next decade and beyond may be even more exciting than what preceded it. If that's not completely certain, what is is that the technological innovations will come at a faster pace than ever before and will affect larger numbers of people and organizations.



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DEC's Ambitious Software Strategy 66

BY TED BUNKER In an attempt to become every MIS professional's essential provider of interoperability glue, Digital is overhauling its Network Application Support services, operating systems and pricing strategies.

Digital's Stone revamps software line.

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RISC WORKSTATIONS

IBM's RS/6000: A 12-Month Checkup 73

BY BOB FRANCIS One year after the RS/6000 introduction, it's clear that Big Blue has finally scored big in workstations. But mixed signals regarding product positioning and SAA compatibility have some users confused.

Delta Metals's Cross wants to grow with the RS/6000.

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A Novell Use For Minis 83

BY BOB FRANCIS Portable NetWare lets Novell clients access applications on a variety of midrange machines from proprietary minis to UNIX-based RISC screamers.

Evans & Sutherland practices a smorgasbord style of computing.

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Sony's UNIX To Go 93

BY MIKE RICCIUTI Sony's NEWS 3250 laptop offers UNIX users what the DOS world has had for years—a portable workstation. But business users may not be ready for it.

Sony's Foden hopes business and technical users will hit the road with the NEWS 3250 laptop.

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Have Mouse, Will Travel

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A Novell Use For Minis

Portable NetWare lets Novell clients access applications on a variety of midrange machines from proprietary minis to UNIX-based RISC screamers.

BY BOB FRANCIS

Network planners and managers have recently been the objects of an escalating war between network software vendors. The battle has focused on the right approach to the sitewide and organizationwide networks just beginning to leave the drawing boards.

But many companies' needs are less comprehensive. They want networking software that gives LAN users access to existing minicomputer applications now, without having to implement a lot of new technology.

For such users, LAN software leader Novell Inc. of Provo, Utah, has developed Portable NetWare. It's a C version of the basic NetWare kernel that runs on a variety of midrange systems, including Data General AOS/VS, Hewlett-Packard MPE, Wang VS and UNIX machines. Portable NetWare sits on top of the minicomputer's operating system and enables PC and Macintosh users on a NetWare LAN to access files and peripherals on the host system. As an added benefit, it works with the various NetWare shells, which means foreign systems appear much like the LAN users' native systems.

Novell developed the product to some extent as a challenge to Banyan Systems Inc.'s VINES and Microsoft Corp.'s LAN Manager networking software, according to Michael Millikin, an analyst at Patricia Seybold's Office Computing Group in Boston.

Portable NetWare's UNIX implementation, in particular, will be useful in thwarting Banyan's UNIX-based VINES network operating system. "It's probably not the perfect solution in every case," says Millikin. "But it offers a good, relatively simple way to connect those Novell users to the rest of the corporation."

However, Novell has so far failed to garner support for Portable NetWare from some of the industry's heavy hitters, Millikin says. IBM, for example, has not jumped on the Portable NetWare bandwagon for either the AS/400 minicomputer or the RS/6000 UNIX workstation line, although both are widely expected. Big Blue says NetWare interoperability is an important goal for the AS/400, but would not disclose the path it is taking toward that goal.

NCR Corp., however, has expanded its effort with Portable NetWare. The company is already shipping a version of Portable NetWare for its Motorola-based Tower systems, and it will also unveil a UNIX version of NetWare to run on its System 3000 processor, powered by Intel Corp.'s 80386 and 80486 chips.

So far, 12 companies have opted to become NetWare partners with Novell (see chart, "Who's On The Portable NetWare Bandwagon"). These firms do the porting of NetWare to their systems, and Novell certifies them. The systems companies then sell and service the product through their marketing channels.

Sales have not been very exciting, however. Lee Doyle, LAN research manager at consulting firm International Data Corp. in Framingham, Mass., estimates that only a few hundred Portable NetWare licenses have been sold so far. Doyle says Portable NetWare's attraction is more as an integration package than a broad extension of Novell networks across midrange systems.

Just because Portable NetWare provides some degree of integration doesn't necessarily make it the best solution, says David T. Dunagan, president of Strategic Support Systems Inc., a Dallas-based computer consulting and support company. He believes that many companies would be better off rewriting applications to work in a multivendor environment, rather than finding glue to stick them together.

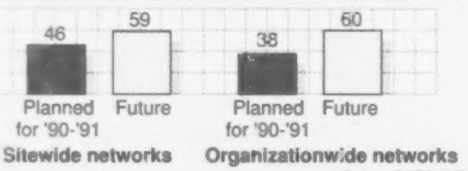
Nonetheless, Dunagan sees Portable NetWare as a good interim solution to getting disparate operating systems to talk to each other. "We've seen some interest in that with some UNIX environments," Dunagan says.

Still, Dunagan points to a good news/

Networks Growing More Extensive

Portable NetWare may fit into the plans of the many IS departments building links between systems and applications throughout organizations.

PERCENTAGE PLANNING TO IMPLEMENT NETWORKS

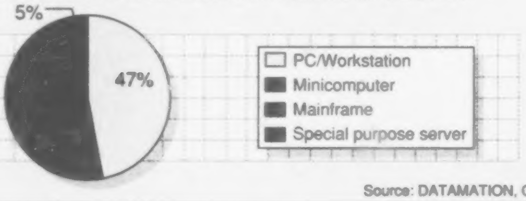


Source: DATAMATION, Cowen & Co.

Minicomputers Continue To Serve

Minis rank as the second most-used machines for network servers.

SYSTEM HARDWARE USED AS NETWORK SERVER



Source: DATAMATION, Cowen & Co.

bad news quality of using Portable NetWare with higher performance computers. "If you're looking at it from the RISC environment, you've got to think that performance is pretty important. If Portable NetWare slows that down, it may not prove to be effective. I can see it for a single application or two, but as an operating system for itself, I don't see it," Dunagan says.

Serving Up Applications

Portable NetWare can be beneficial for companies that practice a smorgasbord style of computing, says Eric Bozich, systems analyst at Evans & Sutherland Computer Corp., a Salt Lake City producer of high-end graphics workstations and simulation software. His company uses a prerelease version of Interactive Systems Corp.'s implementation of Portable NetWare for 386- and 486-based UNIX systems.

☐ WE'VE TRIED OTHER METHODS. BUT THEY HAVEN'T WORKED AS WELL.

"It's a product we've needed for a long time. It's not without its shortcomings, but it provides a real pivotal connectivity point for us within our organization and our goals. So it works very well for us," Bozich explains.

Evans & Sutherland has practiced a smorgasbord style of computing for some time, Bozich says. "We've allowed our people to use the desktop machine of their choice, be it a Macintosh, a PC or a UNIX-based workstation. Of course, depending on what their application is, what their job description is, we may try to give them a little indication of what platform they may want to look at first, but if somebody's comfortable with a Macintosh even though everybody around him has a PC, that's OK. And the various departments have their own mission-critical applications that are running on VAXs and UNIX machines on our network. So we had to provide some way for the end users of the data to get to that," he says.

Bozich agrees with Dunagan that the growth of UNIX and UNIX-based workstations will make Portable NetWare a viable alternative for networks. "UNIX is growing as an operating system and, of course, Novell is the leader in the PC LANs. Finding a way to tie those two things together will add value to those networks," he believes.

Who's On The Portable NetWare Bandwagon

The following companies have announced their intention to release Portable NetWare versions. Those with a check mark were shipping Portable NetWare as of January 1991.

✓Altos Computer Systems
San Jose
Circle No. 350

✓Data General Corp.
Westborough, Mass.
Circle No. 351

Hewlett-Packard Co.
Palo Alto
Circle No. 352

ICL Inc.
Irvine, Calif.
Circle No. 353

Interactive Systems Corp.
Santa Monica, Calif.
Circle No. 354

Intergraph Corp.
Huntsville, Ala.
Circle No. 355

Mips Computer Systems Inc.
Sunnyvale, Calif.
Circle No. 356

✓NCR Corp.
Dayton, Ohio
Circle No. 357

✓Prime Computer Inc.
Natick, Mass.
Circle No. 358

Pyramid Technology Corp.
Mountain View, Calif.
Circle No. 359

Unisys Corp.
Blue Bell, Pa.
Circle No. 360

Wang Laboratories Inc.
Lowell, Mass.
Circle No. 361

Source: DATAMATION, company reports. Circle Numbers appear on Reader Card.

Evans & Sutherland's experience with NetWare for their VAX minicomputers convinced them that Portable NetWare would be a viable concept. Although they are different at the code level, NetWare for VMS is similar to Portable NetWare in that it allows desktop machines on NetWare LANs to access minicomputer files—in this case VAX VMS files. (Ultimately, NetWare for VMS will be rewritten to be very similar to Portable NetWare.) "We've been using NetWare for VMS for some time and, though it's slow, it's proved itself a stable operating system." Bozich.

But VAX-based applications weren't the only ones that Evans & Sutherland wanted to link with Novell NetWare groups located throughout the company. Bozich explains: "We had engineers that were trying to share data files, and there are some administrative groups that need access to manufacturing data. There are a lot of different places where the need for information might exist in our company, and we've tried other methods to link these groups together. But they haven't worked as well."

One method the company tried was to use a of variety TCP/IP software, which solved the basic connectivity problem. That gave users "terminal emulation and file transfer capabilities, which met our needs to some degree," says Bozich. "But what we really needed was for Macintosh users to log onto a UNIX machine and see that as a peer, to see folders as a Mac user sees folders. For PC users, we want to let them map a drive out to their UNIX machine, see files there and be able to use DOS copy commands or Windows 3.0 file manager or whatever tools they're comfortable with and move the files back and forth," Bozich says.

Portable NetWare, in conjunction with Novell's shells for DOS and Macs, does provide users with native file formats. And PC applications that import files from other applications can bring in binary UNIX files transparently. But Bozich has found one significant weakness in the Portable NetWare approach: its handling of UNIX text files.

Although binary files are no problem, text files are saved differently by DOS, UNIX and the Macintosh operating system. Some of Evans & Sutherland's minicomputer applications store data in text files, which cannot be properly read by DOS and Mac users. File utilities are readily available to convert text files, but Bozich says, they add a step that should really be part of the file transfer process.

☐ I UNDERSTAND THAT IT'S GOING TO BE FASTER IN THE ACTUAL PRODUCTION RELEASE.

Bozich has not had serious problems with Portable NetWare's lack of speed. "It's not fast. The benchmarks we ran put it somewhere between NetWare For VMS, which is slow, and NetWare 286. So it's not blazing fast, but it's acceptable, and I understand that it's going to be faster in the actual production release. Its value is more in the connectivity than in the actual file and print server aspects, which is more like a rehash of what you get with 286 NetWare."

For Evans & Sutherland, and possibly for other IS organizations, Bozich points out, "The connectivity is the thing that we bought it for, not its speed," ▭

Sony's NEWS 3250 laptop offers UNIX users what the DOS world has had for years—a portable workstation. But business users may not be ready for it.

Sony's UNIX To Go

ATHOL FODEN, product manager at Sony, hopes business and technical users will hit the road with the NEWS 3250 laptop.

BY MIKE RICCIUTI

UNIX workstation users no longer need be envious of DOS users' high-powered portable computers. Sony Microsystems Co., based in San Jose, has introduced what it claims is a first: a reduced instruction set computing (RISC) portable running the UNIX operating system.

The NEWS 3250 expands Sony's Network Engineering Workstation family of UNIX-based workstations and servers. Weighing in at close to 18 pounds, the machine is roughly the size of typical high-end DOS laptops. At around $10,000, it's also in the high-end DOS portable price ballpark.

Continued on next page.

DATAMATION'S

PRODUCT GUIDE

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CASE Cracks Applications Backlog **97**

A Selected List Of CASE Suppliers **98**

▶ **User Product Review 100**

Peripherals
Have Mouse, Will Travel

Software
Track Your Software Changes

Networks
Bridging The Route

PCs & Workstations
Cicero Meets Excel

Systems
DEC Adds Low-End VAX 4000

▶ **New Product Review 103**

Unlike most DOS portables, the 3250 is designed around a Mips Computer Systems Inc. 20-megahertz R3000 RISC processor capable of 17 million instructions per second performance. It also includes an R3010 coprocessor for number crunching at 1.8 million floating point operations per second.

All that power must be kept on a leash, however. The 3250 has no battery—it must be plugged in.

The company is targeting the laptop at technical users, such as engineers and software developers, as well as at sales and marketing personnel looking for a portable UNIX machine for customer demonstrations. Sony is also hopeful that business users will pick up on the idea of portable UNIX for accounting and desktop publishing, says Sony product manager Athol Foden.

If the company's marketing aim is correct, a UNIX laptop will make even more sense to IS personnel in the coming years, as UNIX permeates the business market.

For computer-aided design (CAD) work, Sony has included an 11-inch monochrome LCD screen with a resolution of 1,120 × 780 pixels. Buyers have a choice of a 240- or 406-megabyte hard disk, for a total system price of $9,900 and $11,900, respectively. The 3250 come standard with 8MB of internal memory, expandable to 32MB; a 3½-inch, 1.44MB floppy disk drive; a small computer system interface (SCSI) port; one parallel and one serial port; and a single expansion slot. The laptop also has a built-in Ethernet port.

Like Sony's other NEWS workstations, the 3250 includes audio input and output capabilities, making the 3250 suitable for business presentations. The machine is shipped with a full version of UNIX System V release 4, X Windows and Open Software Foundation's Motif, as well as Network File System (NFS) software.

Although the 3250 breaks some of the barriers of UNIX computing, market analysts cite the machine's lack of battery power, its weight and its high price as serious drawbacks. Sony says future versions may include battery power, but that would entail a design change, as the R3000 processor is not designed to be battery run. Still, analysts generally agree that Sony has hit the technical market with the right product at the right time.

DATAMATION **March 15, 1991**

IN FOCUS

Sony NEWS 3250 Laptop

Sony Microsystems Co.
San Jose
Price: $9,900
Circle No. 500 on Reader Card

Product Features

- 20MHz RISC processor
- UNIX SVR4 operating system
- High-resolution display
- X Windows, Motif included
- Sound input/output capabilities

Key Benefits For IS

- Portable UNIX workstation
- Network capability built in
- Large storage capacity

Drawbacks

- Weighs 18 lbs.
- No battery power

Source: Company reports, DATAMATION

Too Much Of A Good Thing?

"Nobody has yet attempted to hit UNIX users with a wide-scale commercial product like this," says Brian Jeffery, a market analyst with International Technology Group in Los Altos, Calif. "The power and disk storage are more than adequate for a portable machine. It has the potential to be a big seller in the future. But it may be too much of a high-end product for business apps right now—not the right combination of price and performance."

Jeffery says initial buyers may be users with high-end applications, such as structural analysis and mobile image processing, as well business users of desktop publishing. By far the largest body of initial users will be independent software vendors (ISVs), who will be porting applications to the laptop.

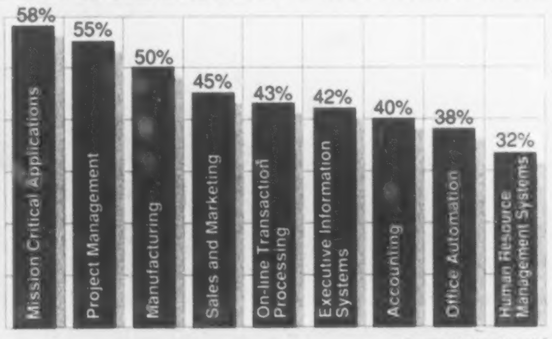
Beta user ISVs confirm that the 3250 has all the horsepower needed to run typical UNIX applications. Many, such as CADshare, a Charlotte N.C.-based publisher of CAD software, have already ported applications to Sony's desktop workstations. CADshare president Paul Pazzaglini says his developers like the laptop's power but want a higher resolution screen and battery power.

Another beta user, Cameron Jenkins of AccuCobol in San Diego, says the performance of the 3250's RISC processor packed into a portable should make it a big seller with technical users and that battery power is not an issue. "Our customers—hardcore UNIX programmers—are not used to battery-powered computers. The idea of a laptop is novel enough to them."

Business Users Check Out UNIX

Sony's UNIX laptop may not find a home in business applications right away, but 84% of 129 businesses surveyed said they are now using UNIX for at least one business application.

PERCENT OF USERS RUNNING EACH APPLICATION ON UNIX:



Source: International Data Corp.

MARKET INSIGHTS

AN ANALYSIS OF ECONOMIC TRENDS

No Failure To Communicate

BY MADELINE FRANCHI
Cahners Economics

The DATAMATION Information Systems Performance Indicator (ISPI) slipped almost a point and a half to 97.39 in October from September's figure of 98.80, pretty much as expected. Relative to October 1989, the ISPI fell 6.8 points. Although new orders for IS equipment dropped slightly in October, they were still 13% higher than they were in October of 1989. This surprising strength, especially during the aftermath of the Iraqi invasion of Kuwait, kept the indicator from falling even more sharply.

But the big surprise was the strong increase in orders for commercial communications equipment, which really saved the indicator from a far more serious decline. IS managers may be holding back on some computer hardware purchases, but they seem to be more willing to part with dollars for networks and multiplexers.

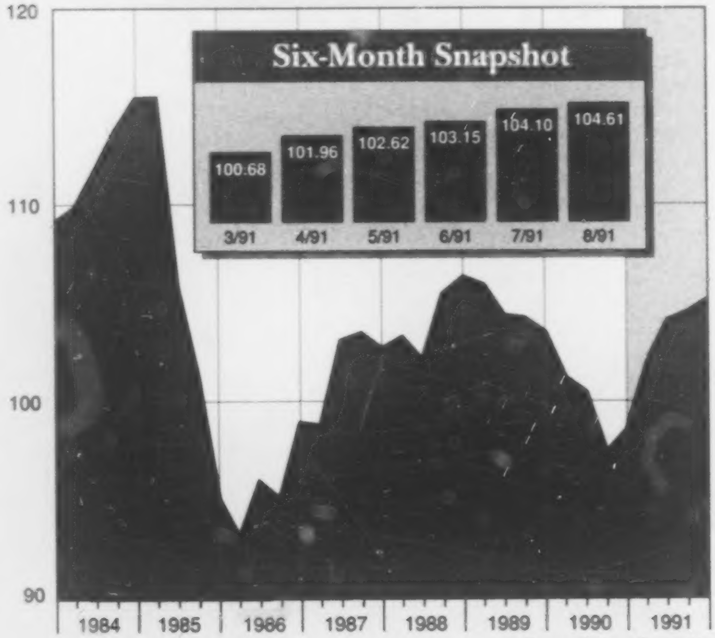
The weakest component in the indicator, however, continues to be the computer systems stock price index, the element most influenced by confidence levels and expectations. Between October 1989 and October 1990, the Standard and Poor's computer stock price index plunged 14.5% amid reports that profits were falling below investor expectations. According to Harvey L. Poppel, a partner at the Fort Lee, N.J.- based investment firm, Broadview Associates: "The massacre in IS stocks has occurred despite a cumulative annual revenue growth of nearly 14% over the past 12 months."

Which is why we continue to forecast a relatively short, mild recession for IS. Once the stock market rises to reflect those earnings, which should happen soon, the ISPI will rise past the 100 mark—perhaps as soon as the end of this month.

For more information on Cahners Economics's forecasting services, including seminars, newsletters and database diskettes, call Dan Buchan at (617)-630-2105, fax him at (617)-630-2100 or write to him at Cahners Economics, 275 Washington St., Newton, MA 02158.

The IS Performance Indicator

Is it the darkness before the dawn that gives that bleak look to the IS indicator this month?



*Shaded area denotes forecast

Source: Cahners Economics

	Oct. 1990	Sept. 1990	% Change 9/90-10/90	Oct. 1989	% Change 1989/1990
■ **Information-Processing Equipment**					
Shipments (SA, $ billions)	10.52	10.07	4.4	9.20	14.3
New Orders (SA, $ billions)	10.38	10.46	-0.7	9.18	13.1
Unfilled Orders (SA, $ billions)	29.05	29.18	-0.4	28.42	2.2
Inventory (SA, $ billions)	21.03	21.29	-1.2	22.23	-5.4
■ **Computer Production Workers**					
Employment (NSA, thousands)	271.4	272.9	-0.5	289.8	-6.3
Average Weekly Hours (monthly avg.)	41.6	42.0	-1.0	41.9	-0.7
■ **Stock Index**					
S&P's Computer Systems Stock Price Index	154.36	162.67	-5.1	180.54	-14.5
■ **Contracts & Orders**					
New Plant & Equipment (SA, $ billions)	45.2	42.13	7.3	41.79	8.2

SA= seasonally adjusted;
NSA= not seasonally adjusted

Sources: U.S. Commerce Dept. and Standard & Poor's; forecasts: Cahners Economics

MARKET INSIGHTS

A SURVEY OF TECHNOLOGY TRENDS

Laptops Are On The Move

BY WARREN CHILDS
Business Research Group

On the plane, in the train, upstairs, downstairs—laptop computers are popping up wherever you look these days. And no wonder—as shown by the latest survey of DATAMATION's Technology Panel, America's businesses are virtually pushing these portable computers into employees' hands in hopes of increasing their opportunity to do work. A whopping 90% of the survey's respondents say some employees at their locations are using portable or laptop computers.

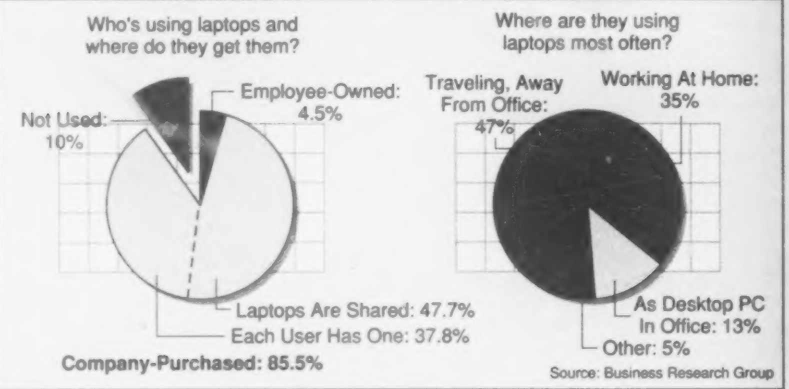
Thirty-eight percent of survey respondents say their companies are purchasing laptops outright for those employees. Another 48% say their companies make laptops available on an as-needed, temporary basis. Employees must sign them out for specific uses, then return them.

The biggest users of laptops are salespeople, field service staff and others who frequently travel or work at home. Panel members estimate that 47% of the time, laptops are being used during business hours by employees while they are away from the office; 35% of the time, employees are taking them home to work; and 13% of the time, they are using them in the office.

Portable computers are the fastest growing segment of the computer industry right now. Portables and laptops are for the most part no longer heavy luggables—although a resilient market for the versatile luggables still exists among personnel servicing computer-related machinery. Indeed, most laptops are now pint-sized systems that can easily fit into a briefcase, and some can fit into a pocket (albeit a wide one). The street price for these little wonders—say a 16-megahertz 80286-based portable with VGA display, 20-megabyte hard drive and built-in modem—is down to $2,000 or less. ▭

For more information, call Nancy Finn at (617)-964-6204, fax her at (617)-558-4402 or write to her at the Business Research Group, 275 Washington Street, Newton, MA 02158.

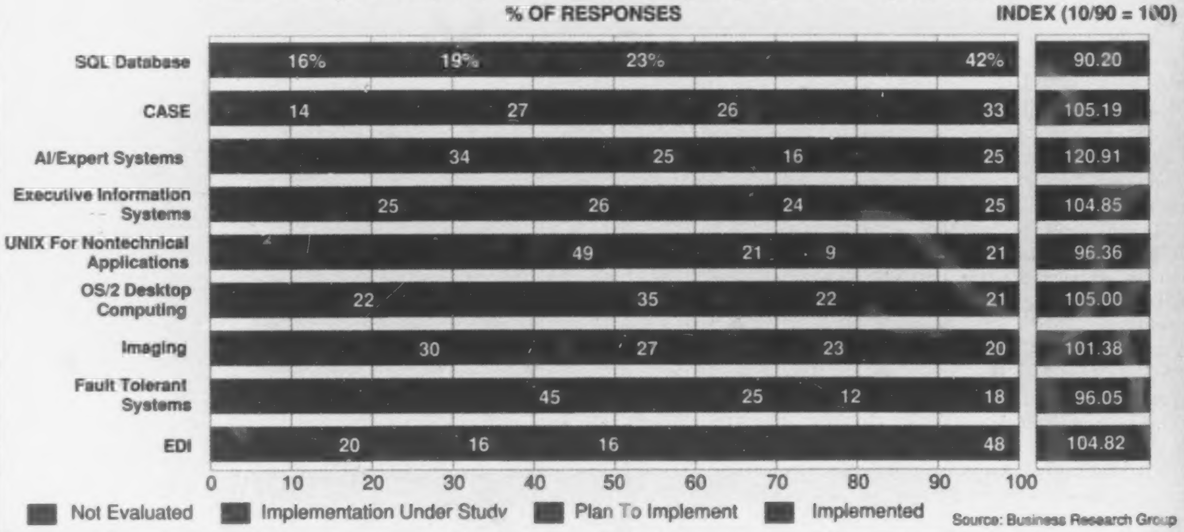
Who Would Ever Use A Laptop?



Source: Business Research Group

DATAMATION's Technology Implementation Index: Systems And Software

DATAMATION each month surveys a select group of its readers– the DATAMATION Technology Panel–to investigate the implementation of new technologies by key end-user organizations.



Source: Business Research Group

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FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE

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Robert S. Epstein, executive vice president, Sybase Inc., with Open Server and Gateways

APRIL 1,
1991

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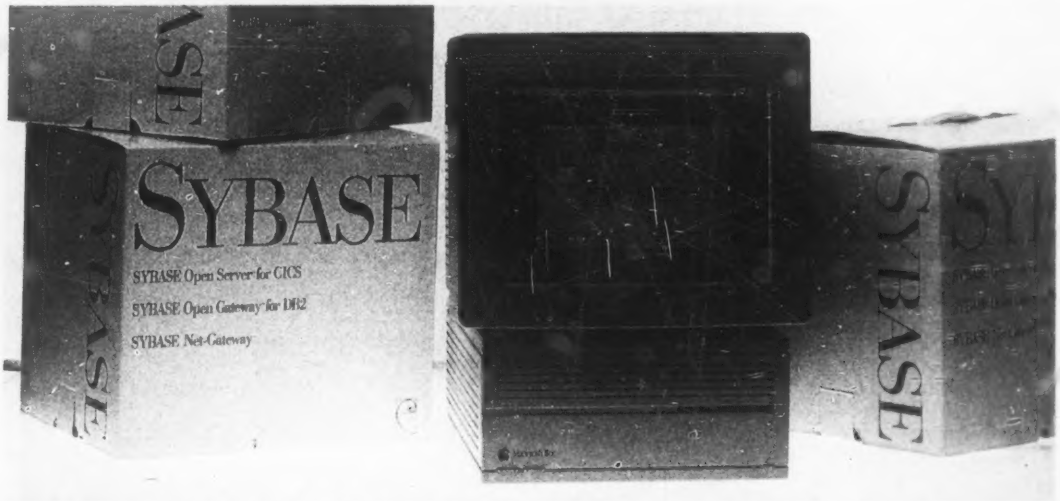
FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE

VOLUME 37
NUMBER 7



With Sybase's Open Server and Gateways, MAC apps can do the two-step with CICS, and DB2 to boot.

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Sybase's Big Blue Connection 28

BY J. WILLIAM SEMICH AND JOHN McMULLEN Sybase isn't waiting for IBM to find a way to hook up its System/390 mainframe to the small-is-beautiful world of workstation/server systems. Open Server For CICS makes your 3090 into a SuperServer—complete with DB2.

Cover photography by Chris Springmann

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RISC SYSTEMS

The 88000: Motorola's Future At RISC 37

BY RICK COOK
High priced and late to market, Motorola's 88000 chip has not fared well in the RISC arena. But a sound software strategy and a strong systems mentality may yet rescue the product.

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Bull's DOS/UNIX Recipe 77

BY MIKE RICCIUTI
The DPX/ProStation comes packed with ready-to-use applications and lets UNIX and DOS software run side by side. But does Bull have the clout to make it sell?

Bull's Hartman has cooked up a workstation with all the trimmings.

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What's Wrong With Windows? 43

BY JEFF MOAD Now that the honeymoon's over, some IS organizations are grumbling over apparent flaws in Windows 3.0. But not everyone notices the problems—and few are ready to forsake Windows for something else.

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NetFrame Serves Storage, I/O Niche 46

BY BOB FRANCIS In the dedicated LAN server crowd, NetFrame has opted for storage and processing capabilities that can handle mission-critical applications.

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Global Downsizes Financial Software 53

BY TOM McCUSKER Maybe—just maybe—you don't need that system upgrade to handle your overgrown financial applications. New cooperative-processing apps can grab MIPS from the desktop and shave mainframe cycles.

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UNIX Waits For A Commercial Break 59

BY PHILIP J. GILL In large commercial shops, most mainframe managers pooh-pooh UNIX as underpowered. Their continued preference: good ol' MVS.

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There Is Life After Outsourcing 62

BY TOM McCUSKER Some IS managers think *outsourcing* means "fire the IS department." It doesn't have to be that way, says Legent vice president Mario Morino. His advice: take charge of outsourcing.

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Living Lab Lights Up The Phone Lines 67

BY IVAN KIRKWOOD The scientists of US West's living lab put an entire town on line—carrying OLTP to the nth degree. The experiment in Bellingham, Wash., is proving that real-time customer service is achievable.

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How Imaging Can Change Your Business 71

BY DONNA TAPELLINI Companies experimenting with imaging are finding that it can provide surprising—even revolutionary—competitive advantages. But imaging presents hefty challenges to MIS.

INTERNATIONAL

Special supplement, not included in all issues. 64-1

MC88200RC20
B81K8815
MC88200RC20
B81K8815

Motorola's 88000 family is not quite a chip off the old block.

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MARKET INSIGHTS

AN ANALYSIS OF ECONOMIC TRENDS

Thinking Of Buying Hardware? Better Do It Now

BY MADELINE FRANCHI
Cahners Economics

Usually in an economic contraction, lead times (the number of weeks between when a product is ordered and when it's delivered) get shorter, and then prices fall. Guess what? Lead times for computers are at an all-time low, and prices are indeed heading down. According to surveys of computer buyers conducted by *Purchasing* magazine, lead times for personal computers dropped from 3.5 weeks in January 1990 to only 2.7 weeks in January 1991—the shortest average delivery time since the survey began.

According to the U.S. Commerce Department, the price index for the computer industry has collapsed from 89.4 in October 1989 to 75.5 in October 1990, a one-year decrease of 15.5%. The deepest price cuts of just over 20% have shown up for computers based on 8000 and 80000 series 16-bit chips and for those based on 80000 series 32-bit chips.

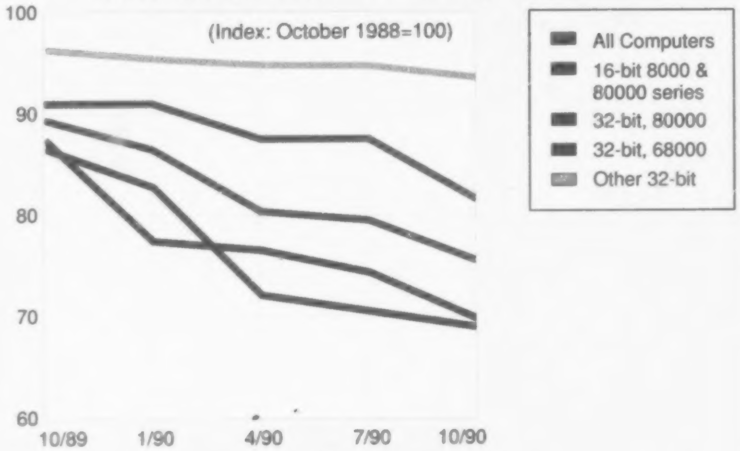
And the economic pressures on suppliers of computers and peripherals to hold down prices aren't easing, either. From October to November last year, output from computer manufacturers plummeted 4.4%. The preliminary figure for December recorded another decline of 2.6%.

The explanation: the industry is still in the process of slowing down and readjusting to a change in users' buying plans that started 1988, when an IS downsizing trend began to set in. Like most other sectors of U.S. manufacturing, the computer industry is both restructuring, squeezing employment ranks and trying to boost productivity. By the end of last year, U.S.-based computer manufacturers employed only 270,000 workers—the lowest level since 1980. ▭

For more information on Cahners Economics's forecasting services, including seminars, newsletters and database diskettes, call Dan Buchan at (617)-630-2105, fax him at (617)-630-2100 or write to him at Cahners Economics, 275 Washington St., Newton, MA 02158.

No Better Time To Buy Computers

Prices of all sizes and types of computers have taken a dive in recent months. Recommendation: buy now, or pay later.



Source: U.S. Commerce Dept.

The Economy At A Glance

U.S. Economy: Macroeconomic And Industrial Indicators

	Actual		Forecast (Annual % Growth)		
	Q2/90	Q3/90	1990	1991	1992
Gross National Product	0.4	1.4	1.1	0.9	3.1
Business Investment In Equipment	-3.3	10.2	2.3	2.4	4.6
Government Spending	6.2	1.2	2.4	0.5	3.8
Consumer Spending	0.2	2.7	1.2	0.6	2.5
Exports	-5.0	6.9	5.3	3.1	5.4
Imports	0.7	7.6	3.3	2.2	2.7

All calculations are % change in 1982 dollars; quarterly figures are seasonally adjusted annual rates.

	Nov.	Oct.	% Change 11/90-10/90	Nov. 1989	% Change 1990-1989
Manufacturing Production (1)					
Process Industries Total	107.1	108.8	-1.6	107.8	-0.6
Chemicals	109.2	110.6	-1.3	109.8	-0.5
Petroleum	105.8	108.6	-2.6	109.3	-3.2
OEM Total	110.9	114.4	-3.1	111.2	-0.3
Computers & Peripherals	146.5	153.3	-4.4	141.0	3.9
Communication Equipment	110.6	110.1	0.5	107.6	2.8
Transportation Equipment	99.9	109.1	-8.4	102.8	-2.8
Services Employment (2)					
Finance, Insurance, Real Estate	6.812	6.824	-0.2	6.752	0.9
Health Care	8.334	8.286	0.6	7.739	7.7
Computer & Data Processing	0.818	0.811	0.8	0.770	6.1
Transportation/Utilities	5.909	5.921	-0.2	5.735	3.0
Retail Trade	20.058	19.812	1.2	20.031	0.1
Wholesale Trade	6.352	6.373	-0.3	6.344	0.1
Government	18.728	18.555	0.9	18.275	2.5

(1) Index 1978=100, seasonally adjusted
(2) Millions of persons, not seasonally adjusted

Source: Commerce Dept. and Cahners Economics

MARKET INSIGHTS

A SURVEY OF TECHNOLOGY TRENDS

The MIS/Telecom Merger Continues

BY WARREN CHILDS
Business Research Group

The move by *Fortune* 1,000 firms to consolidate MIS operations with telecommunications departments is accelerating. Already, according to the most recent DATAMATION Technology Panel survey, some 72% of these large operations have either merged both departments outright or have both report to the corporate Chief Information Officer to ensure consistent management of these two closely related activities.

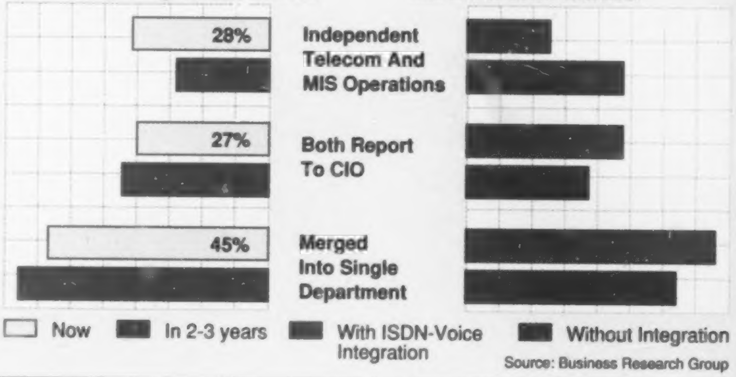
In this month's survey, we asked panel members to indicate whether their MIS and telecommunications groups have been combined into a single organization, were completely separate organizations or were separate organizations that reported to the same CIO.

The results: Only 28% of our panel members report that these groups are completely separate today, 27% say both groups report to the same CIO and 45% report that both groups have already been merged into a single organization.

Still Equal, No Longer Separate

The ties that bind MIS and telecom departments are getting tighter and tighter at a growing number of firms.

Companies with existing ISDN-Voice integration are most likely to merge MIS and telecom activities:



Source: Business Research Group

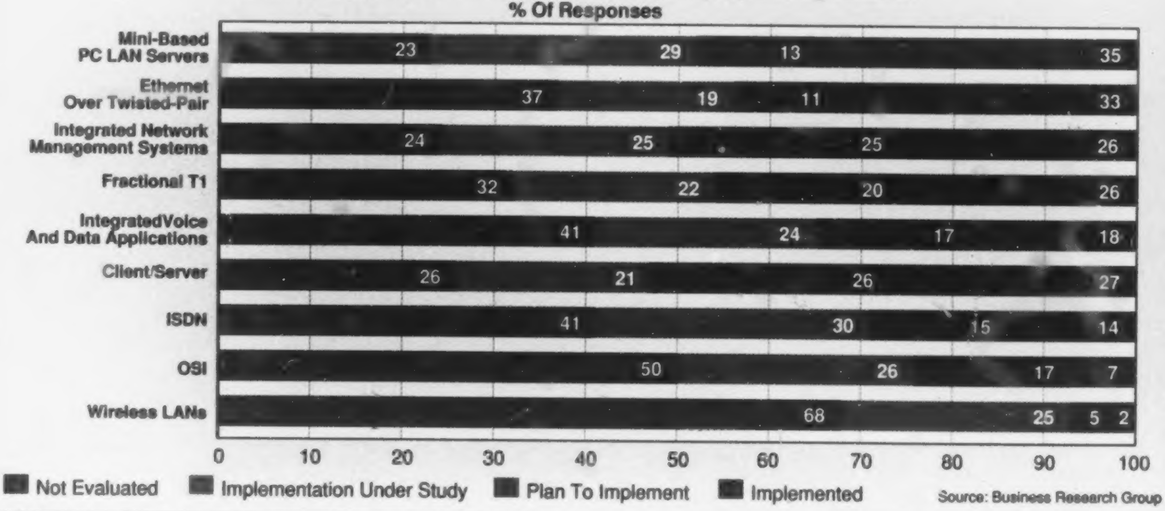
And our panel members confirm that the urge to merge will continue: only 19% report that they expect these two groups to stay independent within the next two to three years.

Organizations that have already implemented integrated voice and data applications are much more likely to have also merged their telecommunications and MIS groups. Only 17% of those who have implemented integrated applications, compared with 32% who haven't, report that these groups are completely separate.

For more information, call Nancy Finn at (617)-964-6204, fax her at (617)-558-4402 or write to her at the Business Research Group, 275 Washington Street, Newton, MA 02158.

DATAMATION's Technology Implementation Index: Networks/Communications

DATAMATION each month surveys a select group of its readers--the DATAMATION Technology Panel--to investigate the implementation of new technologies by key user organizations.



Source: Business Research Group

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DATAMATION

FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE

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APRIL 15,
1991

DATAMATION

VOLUME 37
NUMBER 8

FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE

The future holds dramatic changes for NetView, like abandoning its proprietary core architecture altogether.

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MANAGEMENT

NetView In The Open Era 28

BY SUSAN KERR IBM has started down the long and winding road of open systems with NetView. But the tiger will have to change a few stripes to be more than an SNA supermanager.

Cover photography by Wes Bobbitt

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Budget Growth Skids To 3.4% 44

BY JEFF MOAD

Recession, continued decentralization and skepticism over information technology's payoff have slowed 1991 budget growth dramatically.

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The Object Of Borland's Vision 81

BY MIKE RICCIUTI

ObjectVision from Borland gives users the ability to develop Windows data entry applications as easily as writing a spreadsheet macro.

Borland's Garvey wants to see users develop applications.

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OS/2's Second Coming 49

BY JOHN McMULLEN The new OS/2 will arrive later this year with less fanfare than anticipated. With little chance of owning the desktop, version 2.0 nonetheless shows promise as a development platform and as a way to power up file servers.

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BY TOM McCUSKER General Electric Information Services is working with big companies to recruit the many small firms needed to make electronic data interchange practical.

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BY MARK SCHLACK A new study of IS plans shows creeping networkism in big companies, with manufacturing firms taking the lead. Opening systems up will go hand in hand with cost-reduction measures.

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Tools To Automate Quality Production 63

BY JEFF MOAD All the talk on the factory floor is about "total quality production." But, when the talk turns to action, more often than not MIS is out of the room. These new quality automation applications could change all that soon.

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BY NED SNELL Multivendor shops provide users with application access from a legion of desktops. But users complain about keyboard and application inconsistency. Now what?

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BY DWIGHT B. DAVIS By mirroring business procedures and practices, workflow software helps to automate image routing and application and database access.

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INSIDE DATAMATION

Budgets: It May Not Be As Bad As It Looks

We've all heard employees complain about tight deadlines. The refrain is usually that too tight deadlines often make it difficult to produce quality products. However, intense deadlines often bring out the best in creativity, whatever the endeavor. That's because tough deadlines demand action. When the pressure's on, the well trained and experienced can take the right action.

When it comes to IS budgets, we think a similar dynamic is at work. Sure, it's tougher to operate when budgets stay flat, grow but slightly or are cut. And, yes, there is a point at which too much change can be deleterious to the organization and its goals. But there is also a vast middle ground where the right thinking can turn a tough budget situation into an opportunity for positive change. We think that IS organizations may be in this situation today. DATAMATION's latest budget survey in this issue's special report, "Budget Growth Skids To 3.4%," page 44, shows they face the smallest budget increase this year since we started the survey in 1985.

How so, you say? Well, with a 3.4% average increase in IS budgets, IS managers will be forced to take a hard look at all activities within their organizations. Base IS infrastructure, staffing levels, and current and new development projects will all have to be rigorously evaluated. What a good time to better align business goals with IS. What a good time to check to see if development projects really improve business processes. What a good time to invest in new, more efficient technologies. What a good time to really get that tight focus that we all talk about so much.

And there's another side to our budget survey this year that must be kept in mind. The survey, mailed in January to 6,000 IS managers across the United States and sent back by 550, was filled out just as the war in the Middle East was getting under way, recession fears were at a high pitch and consumer confidence was ebbing. Now that the war is over, there are signs that confidence is returning. We may not see the results of this return immediately, but over time business will begin to feel the effects. Meanwhile, keep the pressure on those budgets, and let the creativity flow.

A New, More Open Look For NetView

For the more than 10,000 computer sites that use IBM's NetView network management system, Big Blue's moves to open up this now proprietary system could have some very positive consequences. The prospect that NetView will be able to interoperate with multivendor equipment, as well as with voice and data devices that do not conform to IBM's System Network Architecture (SNA), will be music to the ears of IS managers struggling to connect disparate networks.

But, as contributing editor Susan Kerr writes in this issue's cover story, "NetView In The Open Era," page 28, the road to this open vision for NetView may not be an altogether smooth ride. "The future holds more dramatic changes for NetView. According to IBM executives, NetView will abandon its proprietary core architecture altogether. This will be a long, expensive path for IBM, and one pitted with potholes. For starters, as the world moves to a more distributed model of computing, NetView's hierarchical network management structure clashes with organizations that are moving away from mainframe-centered systems."

Nevertheless, the changes seem inexorable, and IS managers must plan for them. We hope our story helps you sort out the issues involved in doing so.

David R. Brousell, Editor

Coming Next Issue:

- Inside Pilot's PC-based executive information system
- A look at Intel's new supercomputer
- A roundup of Sun SPARC clones
- Imaging Part 3: forms processing

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Budget Growth Skids To 3.4%

Recession, continued decentralization and skepticism over information technology's payoff have slowed 1991 budget growth dramatically.

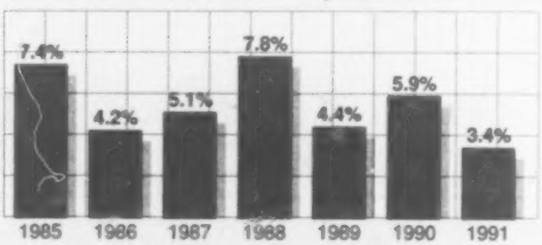
BY JEFF MOAD

To those information systems executives who were still clinging to the idea that IS budgets in the 1990s could retain their immunity from the economic effects of recession, war and corporate restructuring, the results of the 1990–1991 DATAMATION budget survey will be like a quick shot of cold reality.

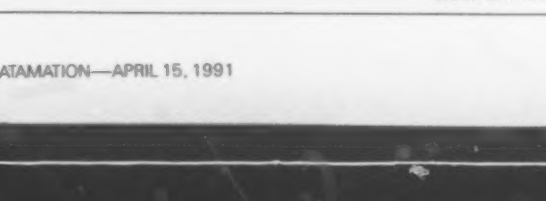
Citing ongoing economic uncertainty, continuing corporate decentralization and a rising tide of upper management skepticism over the real benefits of information technology investments, IS executives said their overall budgets will grow a paltry 3.4% in 1991 more than their 1990 levels. That rate of increase is the smallest since DATAMATION began its annual budget surveys in 1985. IS saw a 5.9% overall budget jump just last year.

Budget Increases Plummet Nearly 50%...

USER SPENDING ON INFORMATION SYSTEMS



As The Boom/Bust Cycle Continues



Source: DATAMATION

Many IS leaders say this year's all-time low budget growth rate is a temporary condition, tied directly to uncertainty over the recession and the recent war in the Persian Gulf. In fact, some say that, until late last year, they had been expecting budget increases at least as large as last year's. But sliding revenue and profit projections, particularly in industries such as air travel, financial services and some segments of manufacturing, have sent IS executives back to the budget drawing boards.

"When we made out our annual budget last October and November, we were looking for substantial growth," says Tom Kiernan, president of the SABRE Computer Services division of American Airlines Inc. "Since then, that has been destroyed by events," as American, like all major international air carriers, had been rocked by customers' unwillingness to take to the skies during wartime, says Kiernan. Kiernan has since cut between 3 and 4% from American's projected IS budget growth. In particular, he has focused on cutting IS personnel expenses. Over the last three to four years, American has been increasing IS staffing by up to 30% per year in an attempt to keep up with growth and demand for new applications. But this year, says Kiernan, SABRE will keep head count growth to a minimum.

The Shrinkage Factor

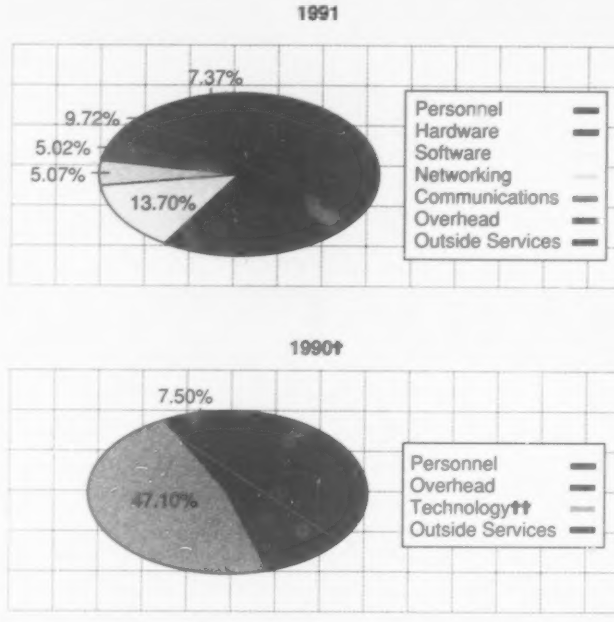
American is clearly not alone in looking to control IS spending by keeping a lid on personnel costs. IS executives surveyed by DATAMATION said the number of IS employees at their locations will increase by an average of less than 1% in 1991 over 1990's levels, to an average staff of 71. Overall spending on IS personnel will grow by only 3.9% in 1991.

Those figure are in sharp contrast to last year's, when IS executives told DATAMATION that their staffs would be growing by more than 13% over 1989 levels.

This year, those expecting IS department staffs to shrink most often cite budgetary squeezes, corporate consolidations and decentralization as the reasons.

Where The Money Is Going

Technology continues to attract the largest part of IS budget dollars.*



* Figures may not add up to 100% due to rounding

† 1990 figures are restated from last year's budget survey

†† Technology in 1990 combined Hardware, Software, Networking and Communications

Source: DATAMATION

At paper manufacturer James River Corp. Of Virginia, all three factors have been at work within the last year, leading to a 25% reduction in central IS staffing. Not only has James River been consolidating, selling off some businesses and merging others, but the company's management last year also decided to consider outsourcing as a way to cut the cost of providing base IS services. According to MIS vice president Jim Miller, the Richmond, Va., company eventually decided to keep the IS utility function in house, but central IS was forced to reorganize and cut head count in order to reduce its costs to match those of the outsourcers.

IS's plans to cut back on staff growth will mean less mobility for IS workers and at least a temporary stall in many a climb up the IS career ladder. "At many companies, there's a freeze on everything," says Bob Reck, a vice president at the IS consulting firm Index Group Inc. in Cambridge, Mass. "And since very few IS people tend to move outside the IS function, that's going to mean a lot of the troops are going to become pretty irritable."

IS's plans to cap spending growth also extend to the purchase of products and services. IS executives surveyed said they don't plan to increase spending for any type of product or service more than 2.7% this year. On average, IS will increase spending on hardware products by 2.3%, networking products by 2.2% and software products by 2.7%. In an apparent blow to the outsourcing concept, IS executives said they'll be increasing spending on outside services by under 1% in 1991.

Besides cutting down on personnel spending, many IS operations seem to be targeting two other areas for savings: discretionary spending on some new application development projects and some expenses related to base IS infrastructure development.

At New York City-based insurance company Metropolitan Life & Affiliated Cos., for example, in addition to cutting back on hiring, IS is slowing the pace of its operating system migration from MS-DOS to OS/2 for its desktop workstations. Since OS/2 requires significantly more memory and often more expensive hardware and packaged applications, staying with MS-DOS longer will lead to a short-term savings.

"It's the kind of discretionary thing we can put off for a while, and [doing so] won't really hurt our business," says IS vice president Daniel Cavanagh.

Cuts in discretionary spending are apparently affecting new PC installations. Respondents to the DATAMATION survey said that only 38.3% of the monies earmarked for PCs will be used to equip employees who previously had no desktop system. Last year, 42.2% of PC spending went for first-time users. A greater share of PC spending—23.3% versus 19.6%—will be for replacement machines this year.

IS organizations that provide IT support through service level agreements or on a transfer-pricing basis say their customers—business units and other users of IT services—have led the push to identify and reduce discretionary spending. Transfer pricing and service-level agreements, by which IS agrees to, say, install a system or provide some level of service for an agreed upon price, require users of IS-supplied services to agree up front on what the IS organization will provide and how much it will charge users on an application-by-application basis. Such systems place the onus for justifying IT spending on the businesses that benefit from the applications. In tight budget times, say IS executives in such organizations, line managers begin to scrutinize proposed IS projects more closely.

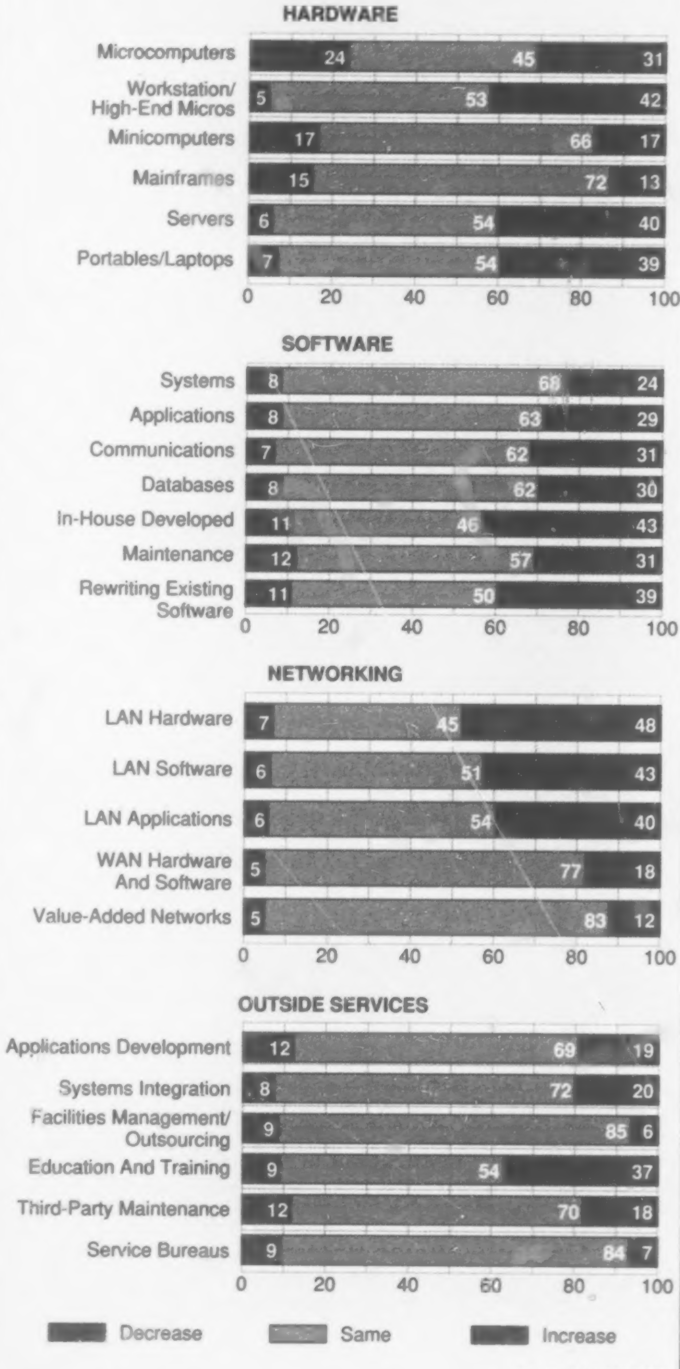
"We're getting into lengthier discussions with our business managers over the costs and benefits of particular projects," says SABRE's Kiernan, who introduced a transfer-pricing system to American Airlines two years ago. In the current environment marked by recession and the recent war, he says, those line managers connected with American's airline and customer reservation system (CRS) businesses, in particular, "are tending to compare the potential benefits of spending on technology with spending in other areas." That inevitably means some discretionary items get pushed down the priority list and deferred, says Kiernan.

Despite cuts, some shops have continued with important new applications development.

Not that all spending on new applications is coming under the knife. Even hard-hit AMR Corp., American's parent, hasn't cut back on development in areas unconnected to the airline business. The company's AMR Information Services organization, for example, is continuing with a joint project to build a ticket reservation system for the French national railroad.

The Choices In Hardware, Software

When asked whether they intend to spend more, less, or the same in 1991 as they did in 1990 on equipment, most IS shops said they plan to hold the line on spending this year.



Source: DATAMATION

And, elsewhere, companies are continuing to invest in new projects, particularly those that have the potential to open up new businesses and bring in revenue. At San Ramon, Calif.-based Pacific Bell Co., where IS is called on to participate in the development of new IT-based telecommunications products, as well as to provide base IT services, spending on new development is up nearly 20%, according to IS chief Jack Hancock. Not only is PacBell's IS department developing a large, new billing system for the company but it is also creating a set of electronic data interchange (EDI) services, which will be offered to PacBell customers.

An Emphasis On Networking

Such ongoing new development is generating IS interest in some key new technologies. In particular, respondents to the DATAMATION survey said they are focusing new spending on some closely linked technologies: local area networks, network management and client/server computing. Eighty-five percent of those answering the survey said they either currently use LANs or have budgeted for them in 1991, 60% said the same about network management products and 43% have implemented some form of client/server computing or plan to do so within the next 12 months.

Technologies that are currently low on the IS list of budget priorities include artificial intelligence, Integrated Services Digital Network (ISDN) products and X terminals.

In addition to cutting spending on some discretionary items, IS continues to focus on getting control of fixed-cost budget items, particularly those related to the kinds of base IS services typically provided by centralized data center operations. Many IS organizations have for the last couple of years been engaged in programs to centralize and automate data centers wherever possible in order to cut costs. That push is continuing.

"We've been involved in consolidating data centers and eliminating duplicate systems," says PacBell's Hancock. "But we feel significant improvements can still be made." In particular, says Hancock, PacBell is now focusing on improving software development methods by using computer-aided software engineering (CASE) techniques and tools in the data center. "We feel we can get better quality and have fewer programmers doing more work," says Hancock.

Although PacBell is increasing spending on product-oriented new development projects by 20% this year, efficiencies and cuts in base IS infrastructure costs will keep the overall IS spending increase at PacBell to about 5%, says Hancock.

Although ongoing data center consolidations may in some cases spur demand for ever larger mainframe systems and play into the hands of vendors like IBM, some IS executives say they may, at least temporarily, postpone purchases of new mainframes in light of the 1991 budget squeeze. "We're seeing a lot of people delaying putting in that new mainframe in addition to trimming staff," says Ben Parke, president of the IBM user group GUIDE Inter-

Since few people move outside IS, a lot of the troops are going to become pretty irritable.

national Corp. "This year, IS is being asked to take cuts just like everyone else in the company."

IS executives believe they aren't the only ones being asked to slow IT expenditure increases. Those surveyed by DATAMATION seemed to feel that many of the same dispersed business units that for the past few years have spent heavily on their own PC-based systems and support staff are also being reined in. IS executives, for example, said IT spending by non-IS organizations at their companies as a percentage of total IT spending would stay essentially unchanged from what it was in 1990, at about 20%. Respondents also said the number of full-time employees at their sites who carry out IS-like functions but do not report to IS also will also remain about the same this year as last. Surveyed IS executives said such employees average 37.5 in number, just over half the size of the average IS department.

Who Holds The Budget Strings?

Some observers, however, say they do not believe IT spending outside IS is as limited as respondents to the DATAMATION survey think it is. Nor are they as sure non-IS IT budgets are under as much pressure as are IS budgets.

"Glass house budgets may be up only 3%, but technology spending by the business units on things like outsourcing, consulting, factory floor automation, EDI, etc., are all zooming," insists Paul Strassman, former chief information officer at Xerox Corp. and currently an IS consultant and author. Strassman says IS executives at many companies have the authority to review business unit IT spending plans for adherence to corporate standards. But, he contends, "The role of MIS to act as a purchasing agent is diminishing."

In fact, experts like Ron Brzezinski, former CIO and current partner at Coopers & Lybrand, estimate non-IS IT spending at closer to 50% of total corporate IT spending and growing.

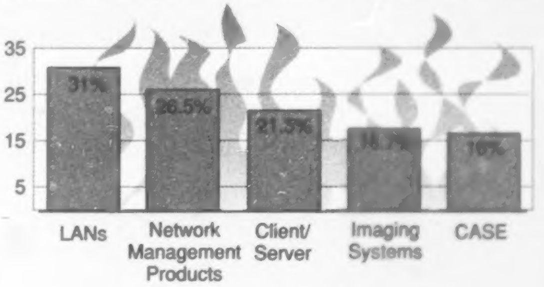
Only one in 10 companies knows their information technology costs or cost dynamics.

The fact is, say an increasing number of experts, IS budgets may no longer be a very good reflection of total corporate IT spending. A recently published book by Peter Keen, executive director of the International Center For Information Technologies in Washington, D.C, for example, says most U.S. companies don't really have a handle on how much they spend on information technology, much less what kind of benefit they get from that money. Called *Shaping the Future: Business Design Through Information Technology*, Keen's book makes the startling claim that U.S. companies are actually spending upwards of 50% of their entire capital budgets on information technology, not the 32% figured by the Department of Commerce.

"Only one in 10 companies knows their IT costs or cost dynamics," claims Keen. CEOs, he says, sense that spending on IT has gotten out of control and has failed to deliver measurable benefits. One response is to slash IS budgets. But that doesn't address the real problem.

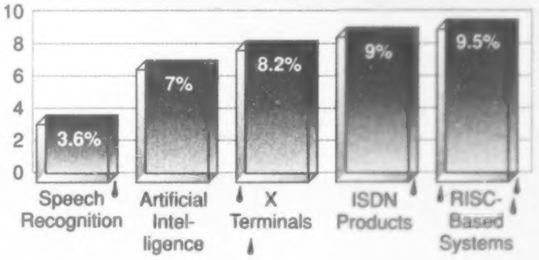
Hot Technologies For '91...

When asked which technologies they intended to spend money on in 1991, IS managers most often mentioned local area networks.



And Those Cooling Off

The fewest percentage of IS executives surveyed intend to spend money speech recognition technology in 1991.



Source: DATAMATION

Some IS executives are attempting to reexert their influence over business unit IT spending. In at least a few cases, that has meant a reversal of recent trends toward decentralization.

Oakland, Calif.-based American President Cos. Ltd., for example, recently moved planning and budget responsibility for dispersed business unit IT spending back to central IS, in an effort to get a better grip on costs. With a few exceptions, CIO James Marston took control of IT and telecommunications spending and was able to reduce expenses on 39 different projects by renegotiating software licenses and maintenance contracts, among other things. Marston says that, so far, the move has saved the shipping company about $3 million.

Despite the current pressures on spending, many executives believe the war's end and an economic recovery will prompt IS budget growth at least on a par with inflation. While a return to double-digit information systems budget growth is almost certainly not in the cards, a healthy economy could lead to sturdy 6 or 7% gains.

"Once the economy turns around, business will start looking to IS for applications," says GUIDE's Parke. ▭

MARKET INSIGHTS

AN ANALYSIS OF ECONOMIC TRENDS

Cool Consumers Chill Out Computer Orders

BY MADELINE FRANCHI
Cahners Economics

Plunging business and consumer confidence in the early winter months of last year put a freeze on manufacturers of information systems equipment. New orders for computers, peripherals and communications equipment plummeted by 9.1% in a single month from October to November of last year, pulling down the annual order rate 1.8% below November 1989's level. And computer industry executives continue to cut back inventory levels. In November 1990, inventory in the IS industry weighed in at just $20.9 billion—a drop of 7.8% from the same period of the previous year. That cutback represented the largest year-to-year decline since the summer of 1986.

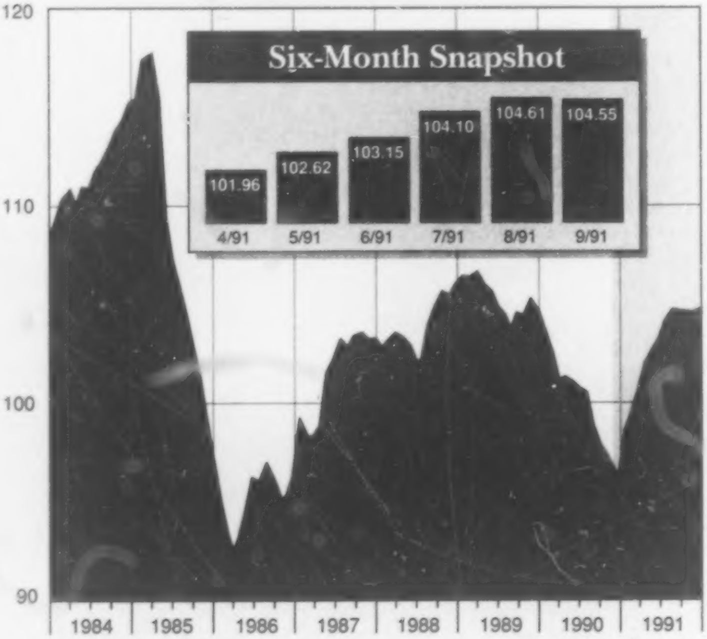
No wonder the DATAMATION Information Systems Performance Indicator (ISPI) continues to fall, down to 96.64 in November from 97.3 in October.

The present poor business investment climate remains a serious threat. Contracts and orders for new plant and equipment for all U.S. industries slumped by 10.2% from November 1989 to November 1990. In November alone, contracts and orders fell sharply to an annualized $39.46 billion, the second lowest level since October 1988. Although one would think that as interest rates head down, business investment should show signs of revival, it hasn't happened that way yet. Cautious banks are counting every dollar they lend these days, and many industries are already over burdened by debt. That means the usual investment recovery that follows a slump may not be so swift or stunning, and the ISPI indicator could rise more slowly than expected.

For more information on Cahners Economics's forecasting services, including seminars, newsletters and database diskettes, call Dan Buchan at (617)-630-2105, fax him at (617)-630-2100 or write to him at Cahners Economics, 275 Washington St., Newton, MA 02158.

The IS Performance Indicator

Forecast for MIS: temperatures falling, but expect a mild warming trend late in the year.



*Shaded area denotes forecast

Source: Cahners Economics

	Nov. 1990	Oct. 1990	% Change 10/90-11/90	Nov. 1989	% Change 1989/1990
■ **Information-Processing Equipment**					
Shipments (SA, $ billions)	9.72	10.55	-7.9	9.49	2.5
New Orders (SA, $ billions)	9.46	10.41	-9.1	9.64	-1.8
Unfilled Orders (SA, $ billions)	28.79	29.04	-0.9	28.58	0.7
Inventory (SA, $ billions)	20.92	21.03	-0.6	22.69	-7.8
■ **Computer Production Workers**					
Employment (NSA, thousands)	270.5	271.4	-0.3	288.9	-6.4
Average Weekly Hours (monthly avg.)	42.1	41.6	1.2	42.3	-0.5
■ **Stock Index**					
S&P's Computer Systems Stock Price index	165.23	154.36	7.0	170.35	-3.0
■ **Contracts & Orders**					
New Plant & Equipment (SA, $ billions)	39.46	42.37	-6.9	43.93	-10.2

SA= seasonally adjusted;
NSA= not seasonally adjusted

Source: U.S. Commerce Dept., Standard & Poor's; forecasts: Cahners Economics

MARKET INSIGHTS

A SURVEY OF TECHNOLOGY TRENDS

Users Bring Imaging Into Fast Focus

BY WARREN CHILDS
Business Research Group

The latest survey of the DATAMATION Technology Panel reveals that end users are moving quickly to implement imaging applications and that growth in these markets should remain strong in the future.

Nearly a quarter of our panel members indicate their companies have already implemented imaging applications; an additional 22% are planning to implement such applications over the next two years. Another 29% say they are studying the possibility of implementing imaging, and only 26% of panel members are not evaluating the technology at all. Just two months ago, only 14% said they had already implemented imaging technology, and 35% said they had no plans to implement it.

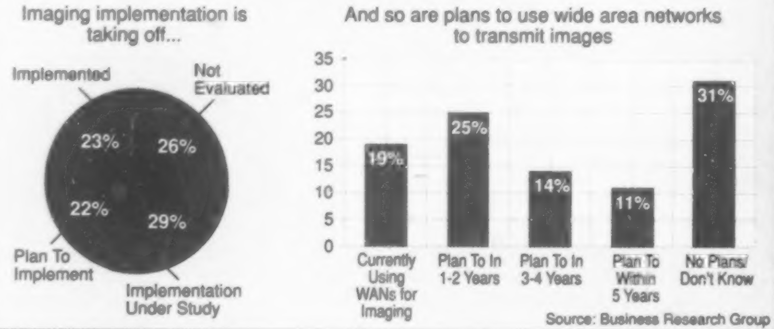
Imaging systems, which store documents directly as image data rather than as text data, are becoming increasingly attractive as a way to reduce the time, space and cost involved in filing and retrieving documents. Documents scanned from paper or created directly at a workstation can be stored on a compact disc, read only memory (CD-ROM) at the network server for quick retrieval by authorized users.

Another emerging use for imaging technology, which is growing in popularity, is for multimedia applications. Using a PC and CD-ROM hardware, multimedia users can access data from reference documents such as encyclopedias or maintenance manuals that could include sound and animation, as well as text and images.

The rising popularity of imaging technology, combined with the increased use of videoconferencing and distributed processing, is driving companies to increase the bandwidth available over both local and wide area networks in order to enable them to transmit this wide-ranging assortment of image data over long distances. Some 44% of our panel members say their companies are already transmitting images over WANs or will be within the next two years.

For more information, call Nancy Finn at (617)-964-6204, fax her at (617)-558-4402 or write to her at the Business Research Group, 275 Washington Street, Newton, MA 02158.

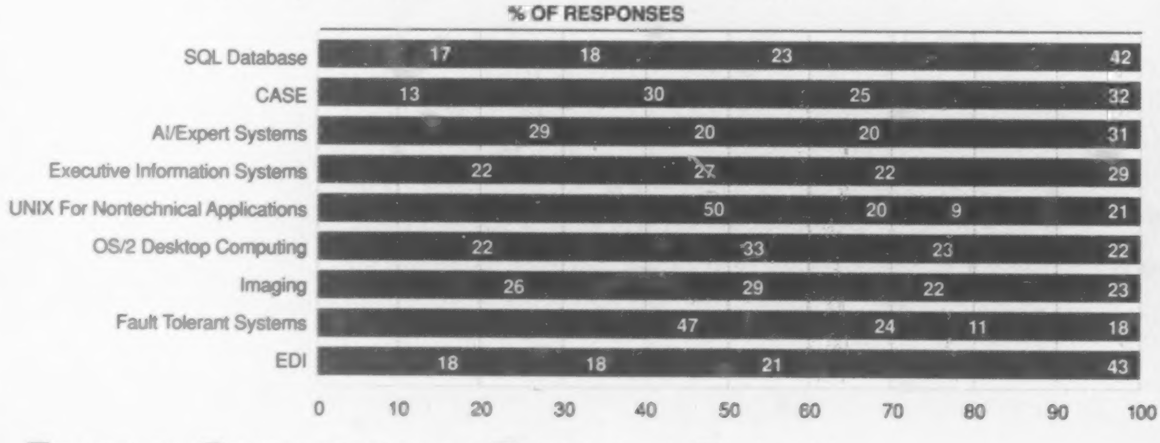
Get The Picture?



Source: Business Research Group

DATAMATION's Technology Implementation Index: Systems And Software

DATAMATION each month surveys a select group of its readers — the DATAMATION/Technology Panel — to investigate the implementation of new technologies by key user organizations.



Source: Business Research Group

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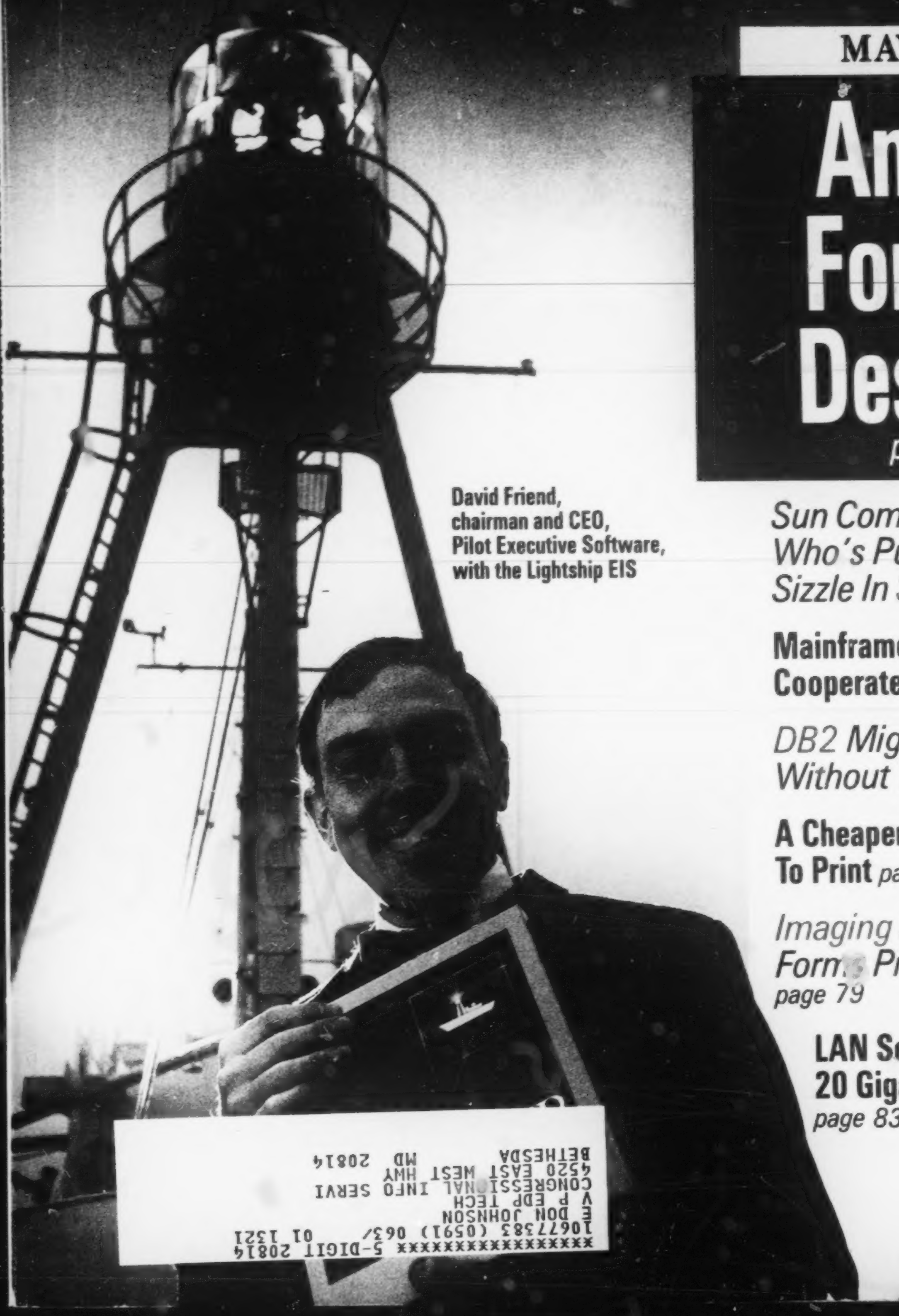
FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE

MAY 1, 1991



David Friend, chairman and CEO, Pilot Executive Software, with the Lightship EIS

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MAY 1, 1991

DATAMATION

VOLUME 37
NUMBER 9

FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE

All aboard! Pilot's Friend steers the way to client/server computing.

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BY PAUL PINELLA Pilot's Lightship is lighting the way to LAN-based executive information systems. But what effect will this have on corporate reporting standards?

Cover photography by Carol Fatta

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COVER STORY

EXECUTIVE SYSTEMS

An EIS For The Desktop

Pilot's Lightship is lighting the way to LAN-based executive information systems. But what effect will this have on corporate reporting standards?

BY PAUL PINELLA

Last September, Pilot Executive Software charted a new course for executive information software. After years of evangelizing the benefits of EIS and building substantial market share with its mainframe and minicomputer-based Command Center EIS products, Pilot announced Lightship—one of the first tools for Microsoft Windows designed to build and run EIS applications on PCs and local area networks.

Lightship represents a major departure from mainstream EIS thinking. Most EIS installations today are elaborate and expensive host-based management-reporting systems that provide top executives with quick access to key company information. Lightship, however, is a relatively inexpensive PC tool for building EIS applications on LANs. And, unlike most host-based EIS applications developed by programmers proficient in specialized languages, Lightship is object oriented. It eschews programming in favor of drop-down menu selections, drawing tools and the mouse. As a result, Lightship theoretically can be employed by any reasonably proficient Windows user to develop, modify and run applications that draw data from any workstation or server on a LAN.

> The danger is that you can get a lot of very nice screens not pointing to the right things.

Because Lightship-developed applications can be used by anyone equipped with a PC running Windows, Lightship could broaden EIS use to include thousands of middle-level managers and other employees who make critical business decisions every day. This objective has been talked about for years; practically all of the major EIS suppliers claim to have already reached out to a wider user base to one degree or another. But, by climbing aboard the Windows bandwagon first and pricing its product so aggressively—Lightship retails for $795—Pilot is in a position to lead the way toward making the transition to a new class of EIS, which it calls the "enterprise information system."

In 1980s computer parlance, the adjective *enterprise* was often used interchangeably with the term *host*. Pilot envisions a different meaning. The Boston-based software supplier sees tomorrow's organization as one where many departments, increasingly dependent upon LANs, are free to develop and use their own EIS systems customized to meet the needs of individual users.

It's a world not without risk. Some Pilot shops see danger in allowing EISs to proliferate in the hands of inexperienced users unaware of corporate data controls. Yet many more IS users are intrigued by Lightship's potential to deliver EIS power to growing numbers of decision makers who rely heavily on spreadsheets, PC databases and LANs. "Lightship is our recognition of the changing role of the mainframe in the corporate-computing structure," says David Friend, Pilot's chairman and chief executive officer. "We are basically saying that over the next five years there will be a move toward client/server computing across the organization."

EIS For Everyone

Most major players in the EIS market, including Pilot with its Command Center family, call upon on IBM mainframes or minicomputers to interact with executives seated at PC workstations. The PCs provide colorful and easy-to-use front ends to centralized EIS databases, along with at least some localized processing. Usually, these interfaces are proprietary and limited to a single company's EIS framework.

Lightship also employs an easy-to-use PC interface. But because it runs on top of Microsoft Windows, Lightship unlocks EIS from proprietary constraints, allowing users and programmers to incorporate data from other Windows applications using Microsoft's Dynamic Data Exchange (DDE) protocol. DDE support also allows Lightship to call upon other Windows packages to supplement its own basic set of EIS development tools. For example, a Lightship application could call upon Microsoft Excel to crunch numbers stored in a Microsoft SQL Server database. It could then pass the information to a presentation package such as Micrografx Charisma to display the information in chart form.

Should the user then want to see more information, Lightship incorporates data "drill down" features standard in most EIS applications. For example, by pointing and clicking on a bar chart indicating, say, $3.5 million in inventory, the user could pull up another chart showing that the inventory consists of $1.2 million in hammers, $1.8 million in nails and $500,000 in spare parts.

Lightship closely resembles other object-oriented PC software tools for building Windows applications, such as Actor from The Whitewater Group Inc., Lotus Development Corp.'s Notes and Asymetrix Corp.'s ToolBook. All of these packages provide us-

Young kids in each of the departments will be able to tackle these applications.

DATAMATION **May 1, 1991**

IN FOCUS

Lightship 2.0

Pilot Executive Software
Boston
Price: $795, single-user license; volume pricing for 5 to 100+ users available
Circle No. 201 on Reader Card

System Requirements

- IBM PS/2, PC AT or compatible with an Intel 80286, 80386 or 80486 microprocessor.
- Microsoft Windows version 3.0 or later
- Minimum of 2MB memory recommended
- 2.5MB of hard disk space
- EGA, VGA (recommended), 8514/A or Hercules graphics card
- Microsoft mouse or compatible

Source: Company reports, DATAMATION

ers with a highly graphical environment where simply pointing and clicking on data enables them to explore data interrelationships. What makes Lightship different from these other tools is its EIS orientation. It includes features for building in what users have come to expect of an EIS application: a data driven design; "hot spots" for drilling down; and dynamic screens.

By offloading most EIS processing chores to the PC, Lightship essentially delegates the data repository role to file servers or other centralized systems. That's why many customers and competitors were surprised last fall when Pilot announced Lightship without any connections to its bread-and-butter Command Center family. The rub is that while Lightship can access and display LAN-based information that might be stored in a spreadsheet file or DDE-compatible database, that same application cannot easily access EIS information stored in a Command Center host-based database—at least for now.

For new users, or those interested in developing low cost LAN-based EISs, that shouldn't be a problem. But users of existing Command Center packages for IBM mainframes running MVS or VM and for Digital VAX computers running VMS will look forward to the next major release of Command Center, version 4A, scheduled to ship early in the third quarter. "It will provide the ability for Lightship to ask questions directly of Command Center with no need for an intermediary product," says Douglas McCartney, product manager.

Meanwhile, Pilot says it is putting the finishing touches on an SCO UNIX version of Command Center designed for use on a LAN. The company says it will also ship this version early in the third quarter, but notes that initially it will

Key Benefits For IS

- Object orientation leads to quick EIS development
- Offloads EIS processing from host to desktop PCs
- Works with all DDE-compatible Windows applications
- Gets users involved in creating own applications

PILOT'S FRIEND: The role of the mainframe is changing in the corporate computer structure.

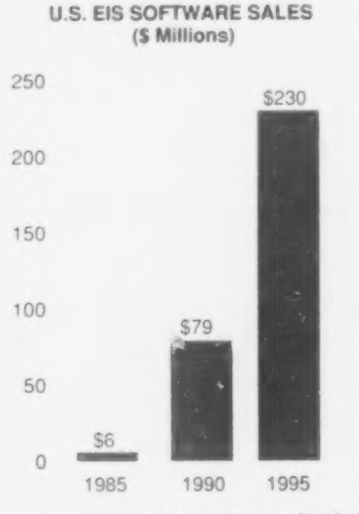
lack direct Lightship support.

That somebody would eventually combine Windows and EIS together is not in itself surprising. Virtually every major software company has announced at least its intention to migrate toward Microsoft's hugely successful graphical environment. What is surprising is that a company so mainframe oriented as Pilot would be first out of the chute with a PC product like Lightship.

In fact, Lightship is likely to remain a relatively small part of a software company that garners the bulk of its revenues from big-systems sales. Since its recent acquisition of the TECS division of U.K.-based Thorn EMI Software, privately held Pilot estimates that its 1991 revenues will approach $50 million and that it will employ 350 people. But its mainframe past could pose serious marketing and distribution challenges for Pilot in the future. "I think the intent of Lightship is to address a broader range of users," says Clare Gillan, senior analyst of applications solutions with International Data Corp. in Framingham, Mass.

EIS Software Grows Up

Packaged EIS software sales are on the move. Combined mainframe, mini and micro sales are projected to reach $230 million by 1995.



Source: International Data Corp

"Whether Pilot can pull it off remains to be seen. Lightship broadens the [base of] users they are going after, changes their sale [approach], and their competition."

To reach the PC market, Pilot realizes it must supplement its mainframe-oriented direct marketing approach to software sales. To develop new distribution channels for Lightship, the company is pursuing value-added resellers for now rather than going after software retailers.

Still, many early Lightship customers are drawn from Pilot's current user base, which the company is contacting directly. Many have expressed interest in the company's plans to meld Lightship and Command Center. Others are awaiting Lightship versions of a number of Command Center add-on applications that Pilot currently sells. Among these are Lightship renditions of Advantage, a hierarchical data viewer, and Dimension, a report generator. Both should be available by the third quarter of this year.

A New Kind Of Customer

With Lightship, of course, Pilot also hopes to attract a new set of customers who are convinced that PC-based EIS and LANs are the only way to go. Dan Kiesey, EIS/microcomputer systems manager at Rockwell International Corp. in Cedar Rapids, Iowa, is such a customer. While other divisions of El Segundo, Calif.-based Rockwell are users of host-based EIS systems, Kiesey's division never went that route. Instead, Kiesey attended an EIS seminar last year that convinced him that a downsized approach to EIS made the most sense. "One-third of all sessions were about how to brownnose the big shots to give you $220,000 to start an EIS," says Kiesey. "But we were very interested in a low-cost PC approach."

Two weeks after Lightship's announcement, Kiesey obtained a copy of the program. His group is now building a number of Lightship-based EIS applications that access SQL Server data stored on a 386-based file server. The database itself is an extract from those on HP 9000 and HP 3000 systems that's downloaded regularly to the LAN's file server.

One early Lightship application that Kiesey is readying for field use is a production-reporting system for Rockwell's Collins Air Transport division. It will replace a 256-page paper report that details equipment schedules and shipments from over 200 customers and suppliers. "Using just one screen, our users can do a heck of a lot more than they ever could with that paper report," says Kiesey. "I did this, and I'm not even a programmer. It doesn't hurt to be PC and Windows literate, though."

Keeping programmers out of the picture is exactly the point, says Kiesey. Rockwell doesn't intend to expand its four-person EIS staff just to support Lightship and is hoping that applications, once released to the departments, will be modified and supported by the users themselves. "Our whole approach is end-user EIS," says Kiesey. "Young kids in each of the departments will be able to tackle [these Lightship applications]. It's point and click. Plus SQL is easy enough for people to learn."

While satisfied with the current release of Lightship, Kiesey notes that the product is restrained by a limitation in DDE that restricts all Structured Query Language calls to 256 characters or less. (Microsoft hints that the problem will be solved in the next major release of Windows, expected in the fall.) Kiesey also feels the set of chart options in Lightship is limited. Other users have complained about Lightship's speed, or lack of it, especially when accessing a large amount of SQL information on a file server or host. According to Pilot, this too will be improved in a future version of Lightship.

For some customers, Lightship is attractive because a mainframe-based EIS is simply not available. The Valspar Corp., a Minneapolis manufacturer of paints, varnishes and related coatings, found itself in this situation when it went shopping for an EIS package for its Unisys 1100/92 mainframes. Few such systems were available and none at attractive prices. "A lot of the big EIS packages just won't run on our Unisys mainframes," says Jennifer Weiss, MIS business systems manager. So Valspar went looking for a PC-based solution that could also be used by on-the-road executives with portable PCs.

Lightship is now "the only EIS product we are using," says Weiss. Using a business management report application that Weiss recently completed in Lightship, executives can access up to 27 key company indicators relating to finance and safety. The data are downloaded from the mainframes into dBase files, which are then pulled into Lightship via

MARTIN MARIETTA'S DIAMANTE uses Lightship as a tool for developing computer-based training applications.

Q+E. This is a middleware package from Pioneer Software of Raleigh, N.C., that translates SQL requests into the DDE protocol that Lightship understands.

For every new user to EIS that Lightship brings into the fold, there are at least two other Command Center veterans test driving the product. Martin Marietta Corp.'s Electronics & Missiles Group in Orlando, Fla., counts itself in the latter camp, although it didn't begin to use Command Center until August 1990. That's when the company began to develop Command Center EIS applications running under HP-UX, HP's version of the UNIX operating system, on its Hewlett-Packard 9000 minicomputer. When Lightship was announced shortly thereafter, senior group engineer Michael Diamante saw its potential for developing a computer-based training application to acquaint executives with the features of its EIS. "We found Lightship to be superior for developing a training application, even though that's not what it's intended to be," he says.

> **We took our gamble** with Windows, and spent a lot of time finding Microsoft's bugs.

Lightship is also being used at Martin Marietta to create an organizational chart application. When completed, the application will act as a front end into a Superbase 4 personnel database running on the HP 9000 in an MS-DOS partition. Users will be able to point and click on each branch of the chart and pull up a wide variety of information about individual employees in the company. A security component will restrict certain users' access to sensitive information. Diamante expects the application will be used widely throughout the company once it goes on line.

Getting FOCUSed

Martin Marietta decided not to implement Lightship on a LAN. Users access the HP hosts directly using PC Ethernet connections, essentially turning the HP 9000 minicomputer into a shared PC. More Lightship shops in the future may decide to access host-based DBMS data directly.

With that goal in mind, Pilot in January announced an agreement with New York City-based Information Builders Inc. to create a direct Light-

What The Competition Is Up To

Pilot Executive Software wins plenty of kudos from users and analysts for being among the first to bring Microsoft Windows 3.0 and executive information systems together. But, there's no shortage of challengers to Lightship.

Austin, Texas-based Execucom Systems Corp. praises Pilot's decision to implement Lightship under Windows. (At press time, Execucom officials announced that it was being acquired by Comshare Inc., a major EIS supplier based in Ann Arbor, Mich.) "Pilot's prescient decision to resist the lure of OS/2 . . . was a stroke of genius," says Mark Wood, director, EIS products.

Wood takes issue, however, with a number of Lightship design choices. Among them: Lightship's lack of analytical capabilities, its reliance on visual programming without providing an underlying development language and its dependence on Microsoft's Dynamic Data Exchange (DDE) protocol to the exclusion of more commomly used terminal protocols. Execucom is readying its own Windows-based version of its Executive Edge workstation executive information software, which it says will be available this month.

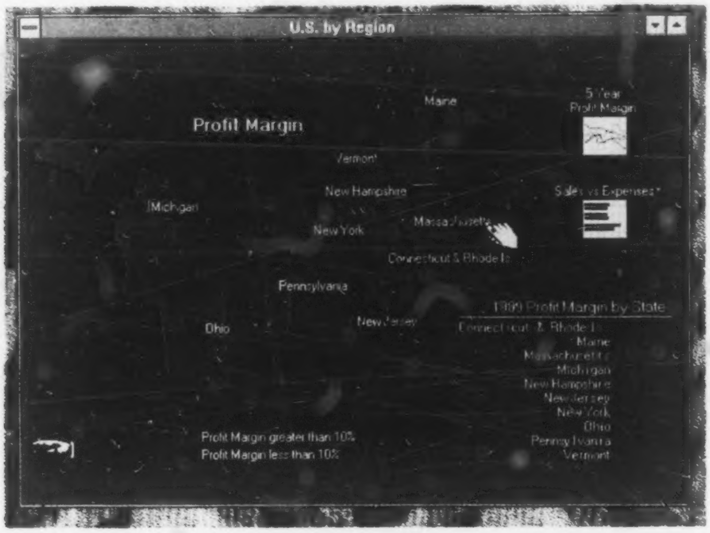
Information Resources Inc.'s DSS Division, an EIS and decision support system supplier in Waltham, Mass., also praises Lightship's Windows approach. "People want to buy a Windows product. We are developing a Windows product. In that sense, Lightship is right on the money," says Jeffrey Stamen, DSS Division president. Where Lightship stumbles, in Stamen's view, is in its lack of integration with Command Center and in its missing Decision Support System (DSS) facilities. "We think that's important," he says.

Comshare finds fault with Lightship's dependence on other Windows packages. A better approach, claims Craig Borrow, vice president of marketing at Comshare, is his company's local area network version of Commander EIS. A single architecture here provides Macintosh, OS/2 and MS-DOS (but not Windows) PCs with access to a single EIS database. "The difficulty you run into is that it [Lightship] is incapable of delivering a methodology for holding everything together."

Bob Gleason, vice president of sales at Easel Corp. in Woburn, Mass., points out what he sees as another problem. He says that his company's Manager's Portfolio product, which is actually a series of EIS templates for developers using the Easel toolkit, is similar in some ways to Lightship. But Gleason says that his company's product offers the added advantage of being scalable—that is, Easel applications developed on PCs can be upgraded to run on larger platforms.

Like these major EIS players, plenty of smaller companies in the EIS arena, many of them with PC-based products, see Lightship as the competition. Info Innov Inc. a small software firm based in Quebec, even challenges Pilot's assertion that Lightship is the first Windows-based EIS for LANs. It says that its Media EIS offering was available to run under Windows long before there even was a Windows 3.0.

ship/mainframe connection. Under the agreement, Information Builders will market Lightship combined with its popular PC/FOCUS fourth-generation language in a bundle called FOCUS/EIS For Windows. In this package, Information Builders will include software that translates FOCUS requests into the DDE format for Lightship. This will enable Lightship to access and display data from the many host data sources that FOCUS can tap into, including DB2, IMS and Oracle. At press time, the software was scheduled for release in March.



UNDER LIGHTSHIP'S visual programming environment, users can define screen icons as "hot spots" that trigger various EIS routines

Sony Corp. of America in Park Ridge, N.J., is a long-time user of Pilot's Command Center products. As a large FOCUS shop, Sony is interested in FOCUS/EIS Windows and is evaluating the product in its Emerging Technology group. According to Gary Fisher, manager of EIS, Sony is considering enhancing a number of FOCUS-based EIS applications with the product.

Fisher believes that the combination of Lightship and FOCUS eventually will extend the use of EIS at Sony to lower levels in the organization. "There's a bigger demand [for EIS] at the lower levels, which are more PC-oriented anyway," says Fisher. "We'll probably be working on joint development efforts with our business groups to develop local EIS applications that are more detail-oriented than our Command Center applications."

Checks And Balances

Lightship and other PC-based tools clearly are destined to play an important role in the evolution of EIS. But it's equally clear that the temptation to build dispersed, departmental EIS applications introduces a number of risks, as well.

Most prominent among these is the possibility of creating dozens of modified EIS applications, each displaying data in a slightly different format or even drawing on data from different sources. It is precisely such a scenario that gives IS managers nightmares—and perhaps could keep the proliferation of PC-based EIS systems at least partially in check. "The key with Lightship is that somebody always understand the data," says David Marshak, senior consultant with the Seybold Office Computing Group of Boston. "The danger is that you can get very nice screens not pointing to the right things."

> **EIS needs data** from other sources; we see Windows as just another piece of the infrastructure for EIS.

Many Lightship users are willing to take their chances. Rockwell International's Kiesey, for example, believes department heads will establish controls to ameliorate the problem of inconsistent report generation and will call upon MIS to reinforce this message. "I work for the manager of IS, the keepers of the family jewels, so obviously we want standardization. But Lightship allows our departments a tremendous increase in efficiency. It's simpler for us to say, 'OK, here are its capabilities.' The department head then has to manage his people."

Meanwhile, Pilot's competitors commend the company for having the foresight to design Lightship around Windows—a number have since announced that they'll be adding Windows to their product lines, too. But in the increasingly crowded EIS arena, competitors are only too happy to poke holes in some of what Pilot says are Lightship's strengths (see sidebar, "What The Competition Is Up To"). They criticize Lightship's current lack of integration with Command Center. They decry its dependence on other Windows packages and DDE to deliver basic EIS functionality.

For example, Lightship lacks an integrated decision support or financial-modeling capability. Although these analytical features can be added to a Lightship application via DDE links—Computer Associates International Inc.'s newly acquired Compete! 3-D spreadsheet can be used for this purpose—critics contend that forcing users to rely too much on third-party products increases complexity and slows down the application.

Pilot, not surprisingly, sees things differently. "Five years ago, you didn't have common drivers, graphical user interfaces, databases and so on," says CEO Friend. "Yet it's a different world now that's moving toward standards. EIS needs data from other sources; we see Windows as just another piece of the infrastructure for EIS."

Precisely what impact Lightship and the pending raft of other networkable PC-based EIS solutions will have on the EIS industry is anyone's guess. In the meantime, Pilot says that release 3.0 of Lightship will be out by August or September with a number of new features. They include enhanced graphics tools, improved documentation, a direct link into SQL Server and a simple programming language.

Yet Lightship is still too new to act as a true industry barometer. Mark Albala, manager of executive support at American Cyanamid Co. in Wayne, N.J., admits that he's not sure where Lightship will lead him. "It's a phenomenal product, but it's too early to discuss any success stories," he says. "But it's opening doors that I didn't expect. I guess it's similar to EIS on the mainframe. It [EIS] started out in one place, then wound up in different places that nobody ever anticipated because it [Lightship] exposes people to a new delivery vehicle." ▭

MARKET INSIGHTS

A SURVEY OF TECHNOLOGY TRENDS

Windows Fever Burns OS/2, Melts Macs

BY WARREN CHILDS
Business Research Group

Microsoft's Windows 3.0 will soon become the fastest selling single software product of all time, having already shipped some 3 million copies in just under a year. The most recent survey of DATAMATION's Technology Panel shows that users have been quick to accept the MS-DOS based graphical user interface (GUI). Nearly three-quarters of panel members say Windows 3.0 is already in use at their sites, and half say MS-Windows will become a standard at their organization.

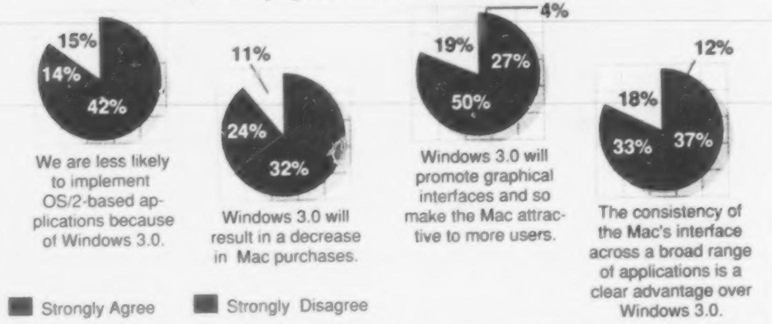
The growing interest in Windows is eclipsing the future role of OS/2 in new applications and could put a crimp in Apple Computer Inc.'s plans to force open a market niche in commercial applications, according to our panel members. More than 70% of panel members either strongly or somewhat agree that they will be less likely to implement OS/2-based solutions now because of Windows 3.0. Ditto for plans to buy into the Apple Mac dream—nearly two-thirds agree that Windows 3.0 will result in a decrease in Macintosh purchases.

Some analysts have predicted that the interest Windows is generating in graphical user interfaces will cause users to take a closer look at the advantages of the Apple Mac, with its well-developed catalog of user-friendly GUI-based applications. So far, this doesn't seem to be the case. Only 4% of panel members strongly agreed that Windows 3.0 might make the Mac look more attractive, although nearly half did agree that the broad range of applications already developed that use the Macintosh interface still could give the Mac a clear advantage over Windows 3.0. ▭

For more information, call Nancy Finn at (617)-964-6204, fax her at (617)-558-4402 or write to her at the Business Research Group, 275 Washington Street, Newton, MA 02158.

Windows 3.0 Is Hot And OS/2 Is Not

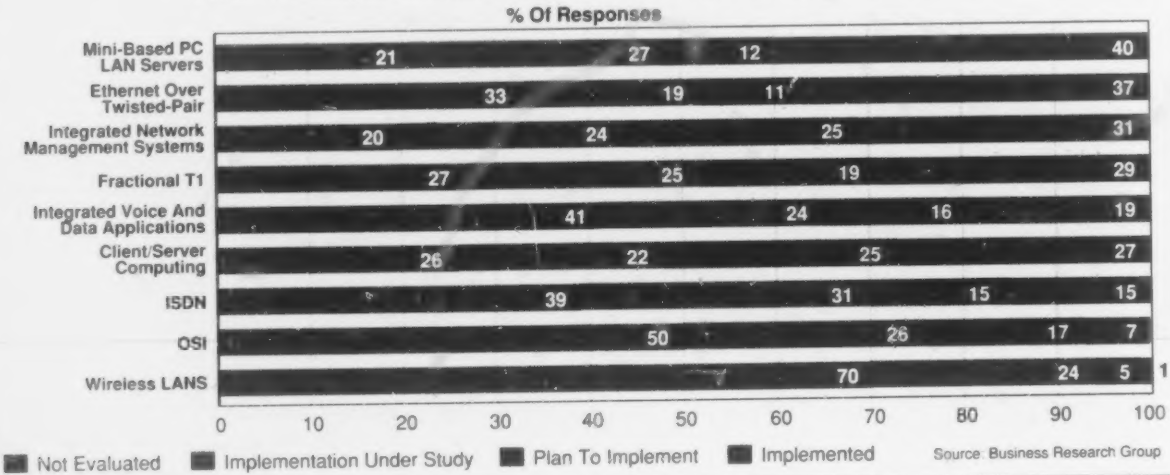
Members of the DATAMATION Technology Panel were asked whether they agreed with the following statements:



Source: DATAMATION, Business Research Group

DATAMATION's Technology Implementation Index: Networks/Communications

DATAMATION each month surveys a select group of its readers—the DATAMATION Technology Panel— to investigate the implementation of new technologies by key user organizations.



Source: Business Research Group

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Dave Mahoney, president, Banyan Systems Inc., with VINES

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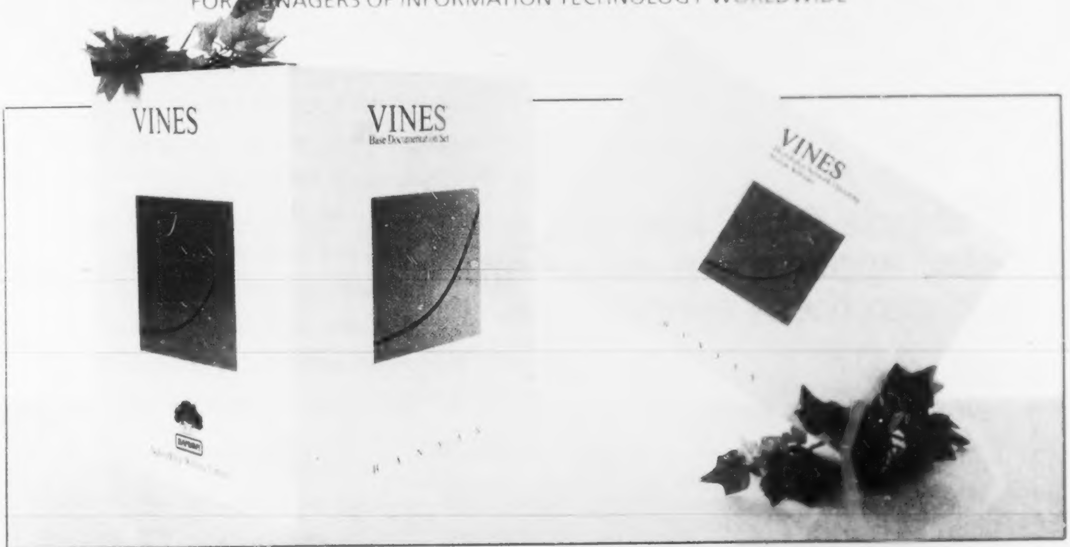

Banyan faces technical as well as commercial challenges before it can take hold of MIS.

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Cover photography by Dave Bradley

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BY LEILA DAVIS IBM's SystemView sounds like a great idea—an integrated systems management architecture open to all. But IBM can't go it alone—12 independent software vendors have signed on to make SystemView real.

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BY JOHN McMULLEN Client/server computing, downsizing and improved PC workstations are contributing to a COBOL renaissance. The language isn't dead. Nor are thousands of COBOL programmers.

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BY DWIGHT B. DAVIS These days, imaging systems are packed with features. But IS managers need to look beyond the bells and whistles to the system's ability to integrate with existing applications.

Union Pacific Railroad rides a sharper image with FileNet.

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BY NED SNELL John W. Turko and his MIS team transformed struggling Kennametal into a profitable global player. But first Turko had to sell a vision: how to use smart IT as a foundation for business.

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Autodesk Connects With Open Systems

In the PC world, Autodesk is the indisputable king of CAD. But, as the world moves quickly beyond stand-alone PCs, the king must play catch-up in networks, workstations and programming support.

BY BOB FRANCIS

Like other successful hardware and software companies that burst forth during the PC revolution of the 1980s, Autodesk Inc. is coming to grips with a very 1990s-style computing reality. Having captured a majority of the PC marketplace with a winning product—Autodesk's AutoCAD computer-aided design package is by far the industry leader—the company now faces customer demands for connectivity and interoperability with other systems.

AutoCAD represents a challenge for IS managers in thousands of design and manufacturing firms. They know that information captured in AutoCAD files represents a strategic resource just waiting to be tapped. But, until recently, trying to link AutoCAD to enterprisewide functions such as databases, back-office functions and manufacturing software wasn't a job for the meek.

That may be starting to change. Last October, the Sausalito, Calif.-based company announced release 11 of its flagship product. The new version of AutoCAD for 386- and 486-based PCs includes greater networking support and improved programming features. And the company has slowly begun to implement a cross-platform strategy for AutoCAD, including flavors for OS/2 and for Sun Microsystems's workstations. Although release 11 isn't yet available for all platforms, Autodesk's game plan is winning support in at least some customer sites.

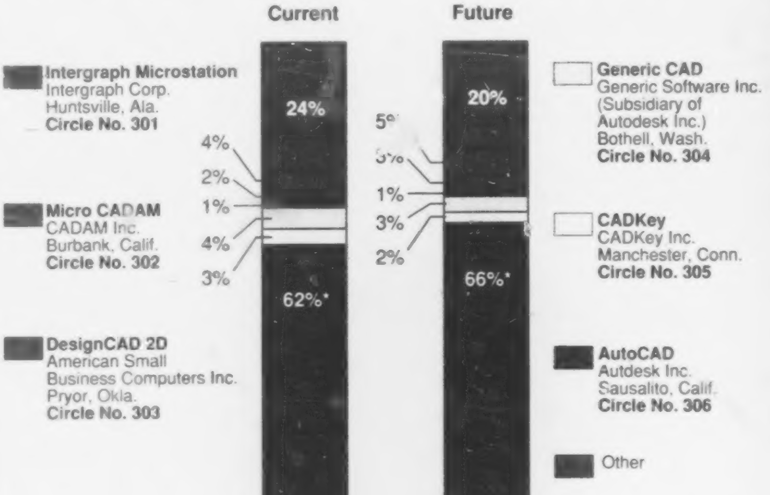
Hughes Radar and Space Systems Group in El Segundo, Calif., is using version 10 of AutoCAD on 28 Sun workstations. Taking advantage of Autodesk's AutoLISP programming language, Hughes integrated AutoCAD with a relational database from Oracle Corp. in an effort to improve the assembly operations in its plants. Planning engineers can now enter assembly instructions into AutoCAD. These instructions are then combined with AutoCAD graphics and data from quality assurance, engineering, processing planning and manufacturing. "It has allowed us to automate that part of the planning process," says project engineer Brant Jones.

Another advantage of this program is that much of the processing takes place on individual workstations, Jones notes. If the processing were centralized, assembly planners would have to wait their turn on a host computer.

Although Hughes Radar demonstrates that AutoCAD does indeed network in the Sun workstation environment, until recently, Autodesk's support of PC networks had been lukewarm at best. Previous versions of AutoCAD could be linked to networks, of course, but Release 11 includes explicit networking features, such as file locking for drawings, and allows users to share program files.

AutoCAD's Growing Grip On CAD

A clear majority of DATAMATION readers responding to the DATAMATION/Cowen & Co.Mini/Micro survey of 1991 buying plans say that AutoCAD will be their choice for PC-based computer-aided design software. Circle numbers appear on Reader Card.



* 56% in 1989 survey

Source: DATAMATION/Cowen & Co.

It also includes an advanced-modeling extension that allows users to produce 3-D wireframe models. Release 11 is the company's boldest attempt so far to build a network-aware version of PC AutoCAD.

On a practical level, Release 11's new networking features reduce the possibility of data loss when two users call up the same drawing simultaneously. More critical for network managers and IS officials is that the new release can be installed on a network server, meaning only one copy of the program requires support. Don't expect a large cost benefit from going with a network server version, however. A 20-user version costs the same as 20 single copies of the program.

DATAMATION **May 15, 1991**

IN FOCUS

AutoCAD Release 11

Autodesk Inc.
Sausalito, Calif.
Price: $3,500 for new users.
$500 to upgrade from release 10
Circle 300 on Reader Card

System Requirements

- Intel-based PC equipped with an 80386 or 80486 processor
- Phar Lap's 386/DOS-Extender running under MS-DOS
- 80287 or 80387 math coprocessor

Key Benefits For IS

- Full compatibility with previous versions of AutoCAD
- Works with a library of more than 550 third-party add-in programs
- Includes the AutoCAD Development System for developing specialized applications in C
- File-locking system to prevent overwriting in a networking environment

Source: Company reports, DATAMATION

The New World

According to Robert G. Herwick, workstation analyst at San Francisco-based Hambrecht & Quist Inc., these new networking features are requirements of the current marketplace. "The new release is an attempt by Autodesk to move up market. They've sold well into single-user and end-user accounts, but now they've got to go after the networking managers and IS departments. To do that you have to offer credible network support. They've done that. And, more importantly, their reseller channel understands that, which means they can sell it," he maintains.

Autodesk officials agree. "Many of the improvements are a result of customer requests for more connectivity, productivity and versatility," says Malcolm Davies, senior vice president of marketing and sales for Autodesk. "That's a key direction for the company in the future," he adds.

☐ THE NEW RELEASE IS AN ATTEMPT BY AUTODESK TO MOVE UP MARKET.

The new release is proving to be something of a double-edged sword, however. As both Lotus Development Corp. and WordPerfect Corp. found out when they pursued their own multiplatform strategies, customers want to be running the latest version of their software across platforms. And that's been somewhat problematic for Autodesk, which has yet to upgrade the 286, OS/2 or Sun workstation versions of AutoCAD to version 11.

According to Hambrecht & Quist's Herwick, the slow delivery of release 11 is hampering some customers who are trying to deal with multivendor heterogeneous environments. "Autodesk didn't realize the extent of this networking phenomenon," he says. "When they just released the 386 version [of version 11]—and not the Sun version and the OS/2 version—fewer users purchased the new release. They need all the versions of the product in order to network their machines together."

Beyond Networking

Beyond improved networking support, release 11's new AutoCAD Development System (ADS)—essentially an extension to the AutoLISP programming language—should further enhance AutoCAD's chances of becoming an enterprisewide package. Users can now write C programs that can be bound directly into AutoCAD. That's particularly important for manufacturers, says Gerald Gallagher, a partner with the Dallas office of Chicago-based Andersen Consulting. "Manufacturers generally have a wide variety of machines and want to be able to write programs allowing those machines to communicate," he says.

Gallagher sees promise in the newer, more open AutoCAD. "One of our key missions is to address the issue of hardware and software investment and connecting those stand-alone processes together," he says. At Andersen Consulting's Infomart exhibit, the company has set up a working program linking an AutoCAD engineering drawing to an AS/400 running MAC/PAC, IBM's manufacturing resource planning (MRP II) package. The demo shows information moving from the design group down to the manufacturing floor and back.

"What we wanted to show with that example is that we can link stand-alone workstations to the rest of the manufacturing environment. Our manufacturing clients want connectivity, but they also want to preserve their investment in their current equipment. Many of them also are aware that a top-down imposed solution won't work as well if the users aren't using the tools they want to use," Gallagher maintains.

New Business

Over time, Autodesk hopes it can transfer this user enthusiasm to some of its newer ventures. The company recently formed a separate business unit targeting high-end design and multimedia applications. One of the unit's first offerings is 3-D Studio, a package that allows users to create animated graphics and special effects for business presentations and training sessions. So far, the company is making only limited progress.

The same is true with Animator, Autodesk's first tool for building multimedia applications. Few observers expect quick success here, mainly because the market itself has yet to mature. "I think before multimedia becomes a viable market, vendors will have to make the technology easier to use and cheaper," notes Bob Simko, an analyst at International Technology Group in Los Altos, Calif. Still, Simko admits that AutoCAD's massive installed base of 450,000 users will put Autodesk in a prime position to sell multimedia applications.

According to Kathy Hale, senior industry analyst for San Jose-based Dataquest Inc., Autodesk's greatest challenge is similar to that of other successful PC software companies. "Once you've proved you can saturate the market, where do you go from there?," Hale asks. "Refreshingly, Autodesk is willing to invest in new technologies that may pay off for them and their customers in the future." ▭

Client/Server's Hot In New Applications

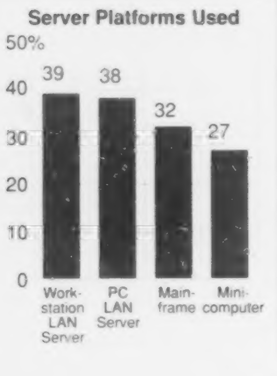
IS managers practicing this new style of computing are not throwing out their old mainframe applications yet. They're cutting their client/server teeth on new apps, using new software technologies.

BY MARK SCHLACK

A new study by the Business Research Group (BRG) suggests that "roll out the mainframe, roll in client/server networks" is not the slogan of the day at most of the IS departments actually implementing the technology in large organizations. Overwhelmingly, client/server computing is being introduced in the form of new applications, not reimplementations of big-iron applications.

These initial attempts at client/server computing are basically tests of the technology, says the study's author, Tom Wood, who is an industry analyst for BRG, a unit of Cahners Publishing Co. in Newton, Mass. To develop them, IS departments are also taking the plunge into modern software development technologies, such as computer-aided software engineering (CASE) and object-oriented programming. And the work is often being done by in-house people wrestling with unfamiliar technologies like remote procedure calls (RPCs).

Servers



The study was based on interviews with 100 IS managers at *Fortune* 1,000 companies, all of which have some experience in client/server applications. In order to qualify as client/server technology, the applications developed by the respondents had to fulfill two basic requirements. First, they had to run on a system involving at least two computers connected together. Second, communication between the two computers had to result in some synergy. These criteria ruled out applications that simply run on a local area network, which BRG had found in an earlier study constitutes client/server computing in the minds of some IS professionals.

Self-Service The Rule

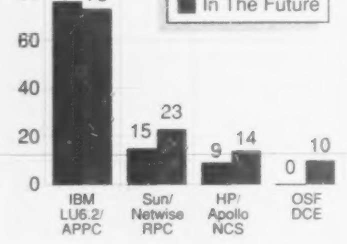
About half of the companies in this study developed their client/server applications using in-house staff. Many companies didn't see the need to employ outside services, and were also concerned about cost, confidentiality and turnaround time.

Whether developed in house or by outside developers, 70% of the applications were brand new, and 30% were reimplementations. Not surprisingly, 63% of the reimplementations were former mainframe applications. Typically, they were interactive time-sharing (48%) or batch (40%) applications; few respondents (13%) ventured into client/server transaction processing. One of the main motives for reimplementation was to shrink substantial backlogs in mainframe development and processing schedules.

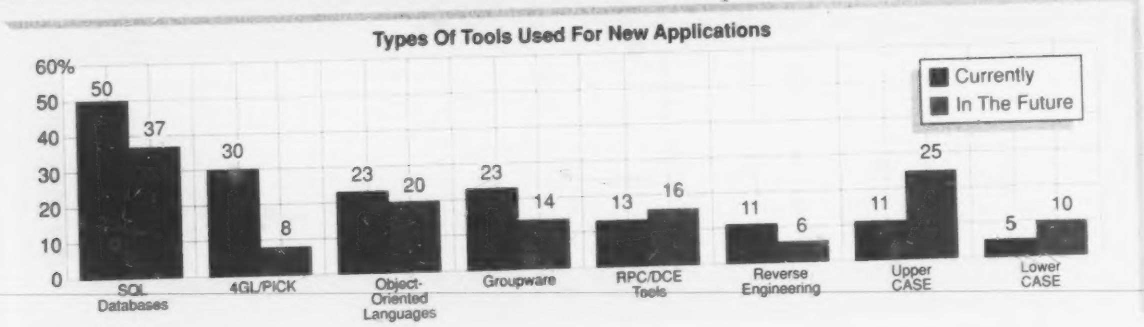
"Right now," says Wood, "client/server applications are generally not reimplemented off the mainframe. But this will change as client/server applications become more complex, and IS develops more expertise."

The implementation of client/server computing is already bringing about a shift toward more modern software technologies. Half of the respondents' brand-new client/server applications were built on Structured Query Language (SQL) databases; 35% of respondents listed SQL databases as the most important tool in developing the application. More than half of the respondents say they rely on the high-level languages supplied by database vendors for development. Only

Communications



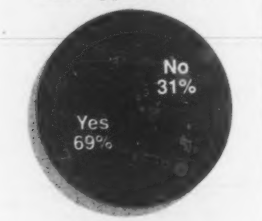
Software Development

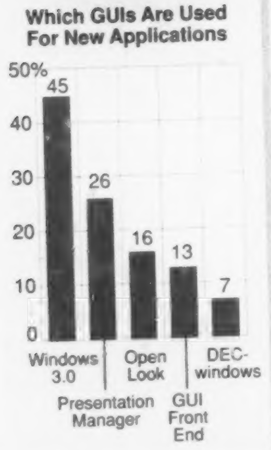


30% got down into the nitty gritty of coding in C. C++, COBOL and other programming languages were used even less often.

The future holds even less hand-coding, according to the survey. When asked about tools that will be used over the coming 12 to 18 months, SQL databases (37%), upper CASE (25%) and object-oriented languages (20%) topped the list. Upper CASE focuses on automating the front-end requirements and analysis and design phases of software development; lower CASE helps programmers with the back-end coding and maintenance functions.

Graphical User Interfaces





Source: Business Research Group

The communications aspect of client/server systems is forcing developers to explore new technologies, as well. Client/server computing requires specialized software to communicate between software modules distributed across the system. The survey found IBM's LU6.2/Advanced Program-To-Program Communications protocol to be the most widely used remote procedure call (76%). Boulder, Colo.-based Netwise Inc.'s RPC Tools, which is licensed by Sun Microsystems Inc., ran a distant second (15%). Survey respondents expect future deployments of client/server applications to largely follow this pattern, as well.

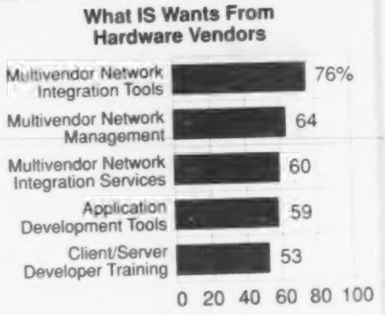
Graphical user interfaces were used in only 31% of the client/server applications. That's surprisingly low, since client/server computing has a strong association in many minds with graphical interfaces. When GUIs were employed, the big winner was Windows 3.0 (45%); Presentation Manager was second (26%).

Future Client/Server Plans

After surviving initial client/server implementations, the 100 IS managers surveyed by BRG are taking the future one day at a time. Practically three-quarters say they will decide on future implementations generally on a case-by-case basis. More than half (53%) are also being driven to employ the client/server model as an outgrowth of general downsizing plans. About two-thirds of IS managers would accelerate their client/server plans if workable software-reengineering tools were available to convert existing applications.

As they move forward, these IS managers are strongly committed to using existing staff, rather than hiring new people with specific client/server skills. That's why more than three-quarters of respondents agreed that retraining their development staff to use new client/server tools and languages poses a major challenge. And the survey shows they expect hardware vendors to play a major role in training developers. They are also looking to vendors to deliver integration tools and services and multivendor network management. ▭

Support



For more information, call Nancy Finn at (617)-964-6204, fax her at (617)-558-4402 or write to her at the Business Research Group, 275 Washington Street, Newton, MA 02158.

MARKET INSIGHTS

AN ANALYSIS OF ECONOMIC TRENDS

The Worst Is Behind Us; The Future Looks Bright

BY MADELINE FRANCHI
Cahners Economics

Ouch! The worsening economic situation in December pulled the DATAMATION Information Systems Performance Indicator (ISPI) down to 95.42 from a revised 96.76 in November. Orders for all types of information systems equipment in December 1990 plummeted 8.8% below their level in December 1989—the first such 12-month decline since early 1987. The full brunt of this crash fell on computer and peripherals manufacturers. Orders received by U.S.-based computer companies in December were 11.7% below the same month in 1989.

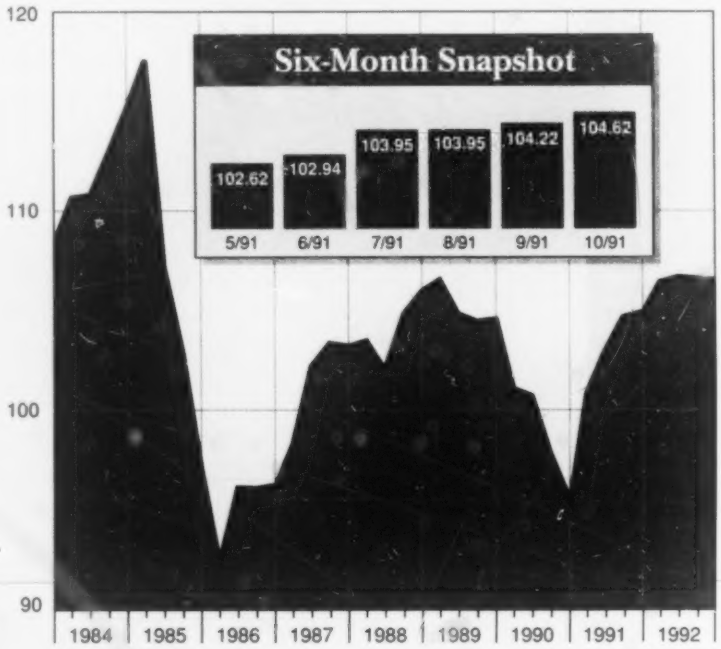
Your suppliers are waiting, in the hope that you will soon start buying in earnest again. With the end to the war in the Middle East, our forecast says you will most likely start investing any time now. Some preliminary numbers for January and February available at press time suggest that investors and businesses had already regained some lost confidence soon after the start of the conflict. The Standard & Poor's computer systems stock price index rose to 180.82 in January—up 7.6% from the same period a year earlier. Furthermore, data from the nation's purchasing managers show an end to the recession coming sometime in the first half of this year. The National Association of Purchasing Management's New Orders Index reversed direction in February after declining for eight months.

We expect the ISPI to make a modest turn upward after January and continue a steady climb ending 1991 at 104.91. The expansion is expected to continue throughout next year, with the indicator surpassing the previous high reached in March 1989. Look for a peak of around 106.7 in mid-to-late 1992. ▭

For more information on Cahners Economics's forecasting services, including seminars, newsletters and database diskettes, call Dan Buchan at (617)-630-2105, fax him at (617)-630-2100 or write to him at Cahners Economics, 275 Washington St., Newton, MA 02158.

The IS Performance Indicator

A Slow Upward Trend Now, But Just You Wait!



Shaded area denotes forecast

Source: Cahners Economics

	Dec. 1990	Nov. 1990	% Change 11/90-12/90	Dec. 1989	% Change 1989/1990
■ Information-Processing Equipment					
Shipments (SA, $ billions)	10.02	9.70	3.3	9.83	1.9
New Orders (SA, $ billions)	9.66	9.48	1.9	10.59	-8.8
Unfilled Orders (SA, $ billions)	28.51	28.82	-1.1	29.31	2.7
Inventory (SA, $ billions)	19.94	20.85	-4.4	22.31	-10.6
■ Computer Production Workers					
Employment (NSA, thousands)	270.2	270.5	-0.1	289.6	-6.7
Average Weekly Hours (monthly avg.)	43.5	42.1	3.3	43.1	0.9
■ Stock Index					
S&P's Computer Systems Stock Price Index	176.9	165.2	7.1	164.3	7.7
■ Contracts & Orders					
New Plant & Equipment (SA, $ billions)	44.9	40.5	10.9	48.9	-8.2

SA= seasonally adjusted;
NSA= not seasonally adjusted

Source: U.S. Commerce Dept., Standard & Poor's;
forecasts: Cahners Economics

MARKET INSIGHTS

A SURVEY OF TECHNOLOGY TRENDS

My Oh My, - Look At EDI Fly

BY WARREN CHILDS
Business Research Group

Fortune 1,000 firms are turning in large numbers to electronic data interchange to conduct a wide array of business activities, from purchasing and receiving goods, through accounts payable, all the way to distribution and sales.

Almost two-thirds of the members polled in the latest DATAMATION Technology Panel survey say they have either implemented EDI already (47%) or are in the process of doing so (15%). And two clear leaders are beginning to emerge in this market, according to panel members: IBM and General Electric Information Services (GEIS).

EDI can either be set up on a private company-to-company network among trading partners or through value-added network (VAN) service suppliers, such as IBM, GEIS and US Sprint Communications Co., which can provide the network services and can perform protocol translation between EDI protocols and company-specific forms transmission procedures.

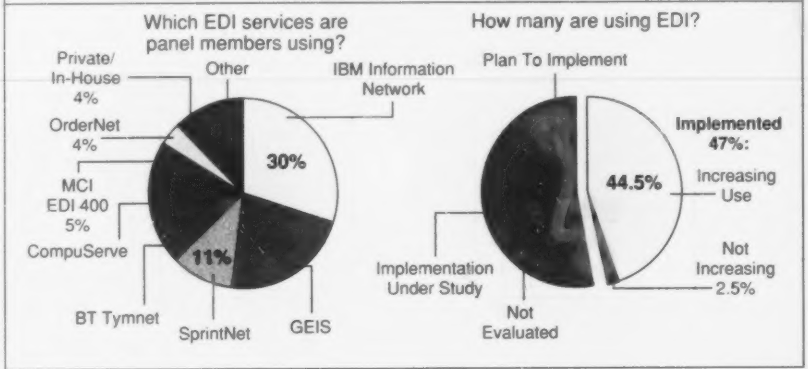
Of the panel members who have already implemented EDI, 30% said they are using IBM's Information Network as the VAN service of choice for their EDI system; 22% said they are using GEIS. Following these two leaders—at a distance—are five other VANs. SprintNet, at 11%, and BT Tymnet, with 9%, head up this pack of also-rans. Only 4% of our panel members say they are using private networks.

By allowing businesses to electronically transmit documents in a standardized format, EDI greatly reduces the cost, time and manpower required to mail and process such documents.

Perhaps that's why virtually all of the panel members who have already implemented EDI (95%) say they plan to expand its use throughout their business operations in the future. ▭

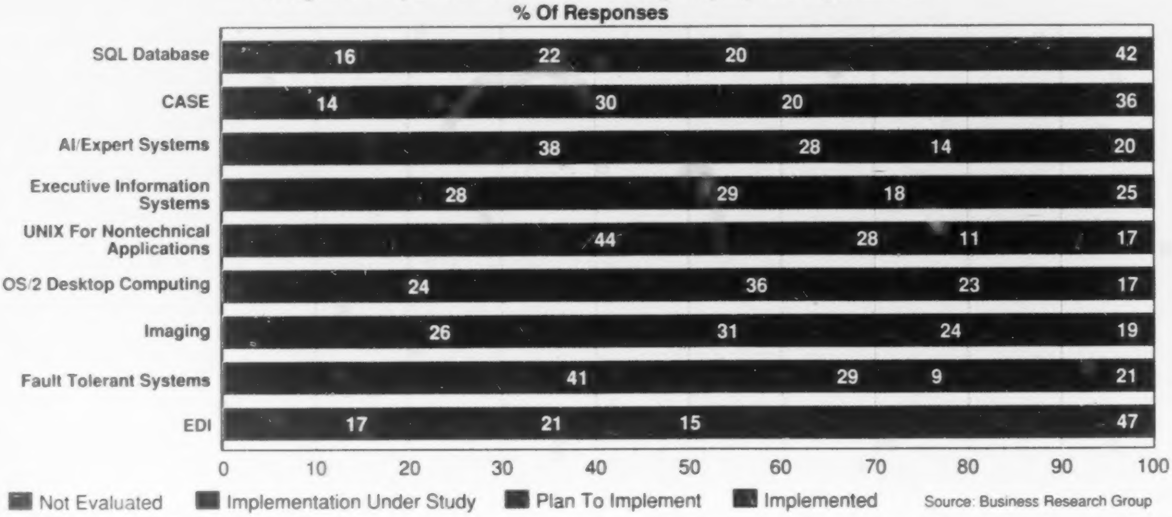
For more information, call Nancy Finn at (617)-964-6204, fax her at (617)-558-4402 or write to her at the Business Research Group, 275 Washington Street, Newton, MA 02158.

Divvying Up The EDI Pie



DATAMATION's Technology Implementation Index: Systems And Software

DATAMATION each month surveys a select group of its readers--the DATAMATION Technology Panel--to investigate the implementation of new technologies by key user organizations.



Source: Business Research Group

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A CAHNERS PUBLICATION

DATAMATION

FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE

C185-5

JUNE 1, 1991

Application Development Control!

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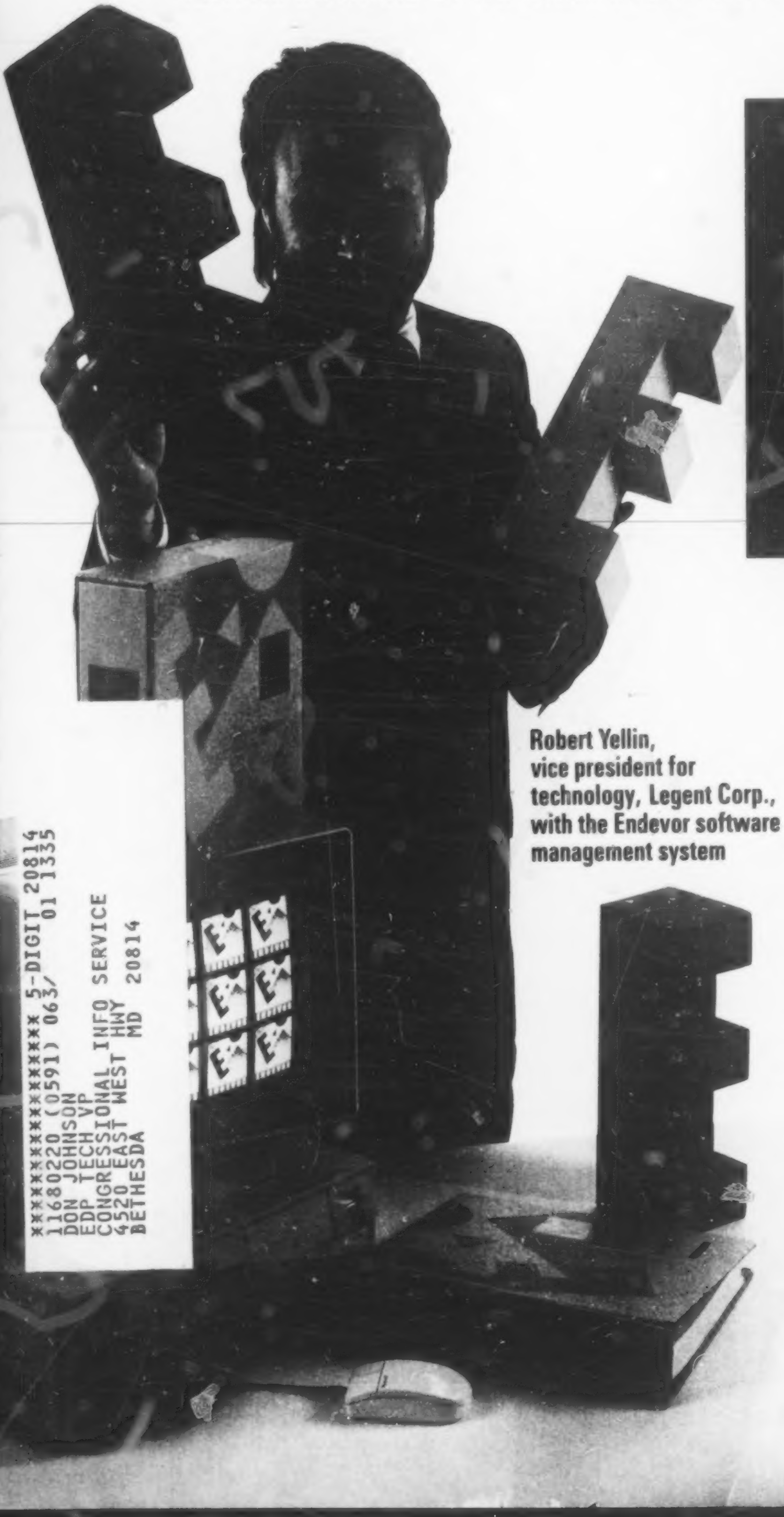

Robert Yellin, vice president for technology, Legent Corp., with the Endevor software management system

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JUNE 1, 1991

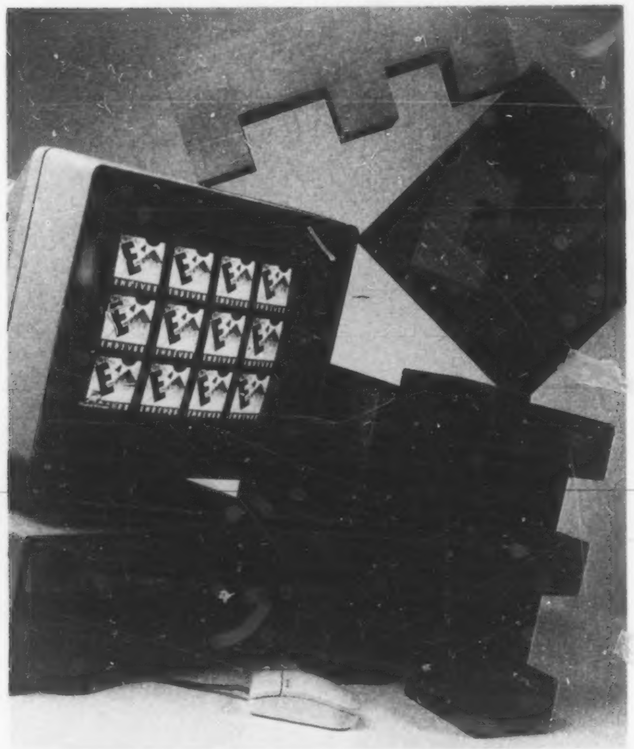
DATAMATION

VOLUME 37
NUMBER 11

FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE

COVER STORY

SOFTWARE MANAGEMENT



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Cover photography by Dave Bradley

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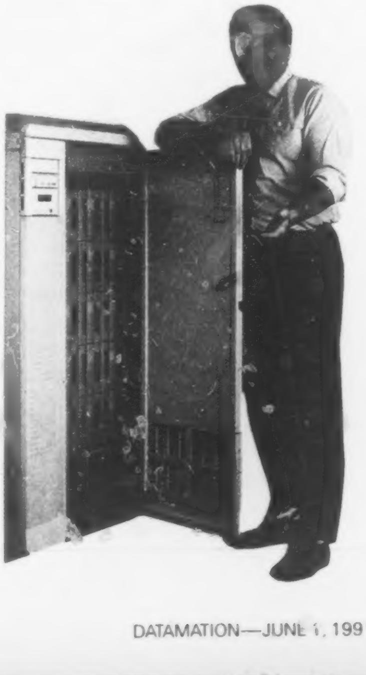
Data General is betting the farm on its new AViiON 7000 and 8000 UNIX servers. But can the company convince customers to gamble on it?



The AViiON 7000 and 8000 UNIX servers will make a spirited run at IBM and HP, says Data General's Marcucci.

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WORKSTATIONS
4th IN A SERIES
RISC PROCESSORS

Mips Computer Systems:
Forging A RISC Workstation Standard

RISC chips designed by Mips now power systems from a number of computer companies. But lack of software compatibility has—until now—kept Mips under Sun Microsystems's shadow.

BY BOB FRANCIS

Timothy Schell has some office space in Florida he's willing to let go cheap. No, it's not in a sinking building or miles from the nearest highway. On the contrary, Schell's office is well air-conditioned and custom-built for the comfort of its former occupant, a Unisys 1855 midrange system.

His organization, the city of Winterhaven, Fla., recently replaced the Unisys system with a RC3230 RISComputer server from Mips Computer Systems Inc. of Sunnyvale, Calif. The RC3230 can sit in the corner of a room built for the comfort of people, not just machines. But the biggest comfort it has brought data-processing manager Schell is the savings. "We estimate the payback at $41,000, so at a savings of $20,000 a year in maintenance alone, we should make that back within two years," he says.

Schell uses the RC3230 primarily for a utility-billing application that previously ran on the Unisys. The application was ported to the Mips machine and to UNIX using software from Migration Technology Ltd. of Maidenhead, U.K., which converted the code from BASIC to C.

Who Is Mips, Anyway?

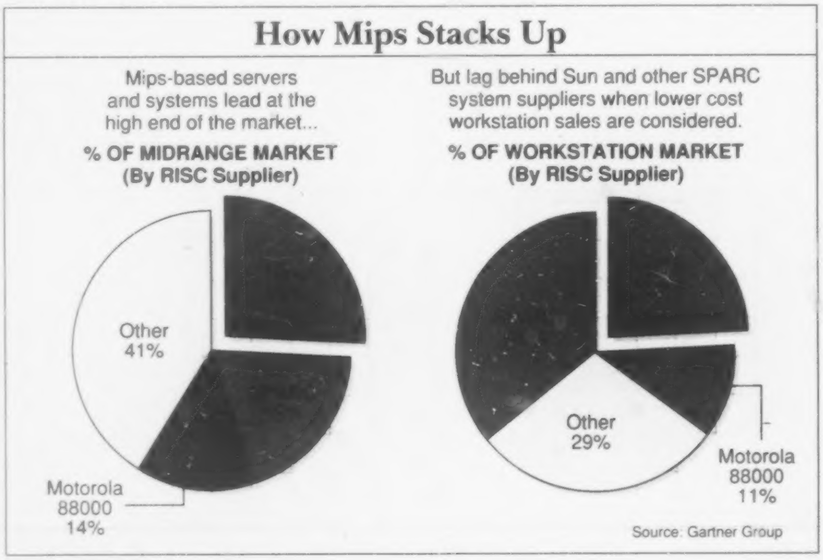
The city of Winterhaven purchased its server from Total Tec Systems Inc., a value-added reseller (VAR) of Mips's systems based in Edison, N.J. Schell admits that, before he bid on a replacement for the Unisys, Mips was unfamiliar to him. "We really hadn't heard of Mips, but we were looking at a way to cut costs and examining Concurrent DOS [from Digital Research Inc. in Monterey, Calif.]. But the Mips system [performance] just blew everybody away," Schell says.

Many IS managers, like Schell, may not be aware of Mips Computer Systems, which is both the design firm behind the highly regarded Mips reduced instruction set computing (RISC) microprocessor and a fast-growing workstation and systems supplier.

One reason for its relative anonymity is that most workstations based on Mips's RISC chips are sold under other well-known names. Companies like Digital Equipment Corp., Silicon Graphics Computer Systems Inc. and Sony Corp. of America design Mips's chips into their own systems. Other well-known companies such as Prime Computer Inc., Pyramid Technology Corp. and Wang Laboratories Inc. are original equipment manufacturers (OEM) for Mips, selling complete Mips systems under their own names. And Mips has also signed-up other customers that sell anything from Mips chips on boards, to subsystems, to full system implementations. Although Mips is primarily thought of as a chip design company, about 70% of its revenue currently comes from systems sales.

"Since many of our chips and designs are sold through other vendors, many users don't realize they've got Mips products in their shops," says John Hime, Mips vice president of systems marketing.

Mips's decision to sell both chips and systems has had a negative side effect.


How Mips Stacks Up

Mips-based servers and systems lead at the high end of the market...

% OF MIDRANGE MARKET (By RISC Supplier)

But lag behind Sun and other SPARC system suppliers when lower cost workstation sales are considered.

% OF WORKSTATION MARKET (By RISC Supplier)

Source: Gartner Group

WORKSTATIONS

4th IN A SERIES

RISC PROCESSORS

Those companies, like Digital, that use Mips chips as the basis for their own system designs, wind up with systems that are not binary compatible with other Mips chip-based systems, such as those from Pyramid. As a result, software for today's generation of Digital workstations won't run on Pyramid systems. The systems that Mips itself makes, which are resold with little modification by other systems makers, are binary compatible with each other.

Binary compatibility may not be a problem for future Mips systems, no matter who builds them, says Sandy Gant, an analyst in Santa Clara with the Stamford, Conn.-based Gartner Group Inc. "As a start-up, [Mips] needed resellers, and they didn't emphasize binary compatibility. But now they're beginning to bring everybody together," she says, referring the recent formation of a consortium, called the Advanced Computing Environment (ACE) initiative, which is rallying around Mips chips as the basis for a new RISC workstation standard (see sidebar, "Mips Moves Into The Mainstream").

Mips Moves Into The Mainstream

If reduced instruction set computing (RISC) workstations were standardized on a single platform, would that ignite the type of widespread growth that PCs enjoyed in the early- to mid-1980s? A new industry alliance announced in April is hoping so. Called the Advanced Computing Environment (ACE) initiative, a new 21-company alliance unveiled a nonproprietary standards-based computing environment that it believes will become the preferred workstation choice of tomorrow. Among the group's plans for the environment are specifications for a platform based on microprocessors from Mips Computer Systems Inc., in addition to support for more standard systems based on 80X86 chips from Intel Corp.

Analysts say that the ACE partners, led by Compaq Computer Corp., Digital Equipment Corp., Microsoft Corp., Mips Computer and The Santa Cruz Operation Inc. (SCO), could change the face of the workstation market—and the computer industry in general. For PC maven Compaq, the expected addition of a line of RISC workstations should help the company diversify into the fast-moving RISC marketplace. And it will give Digital a desktop strategy, which it has sorely lacked ever since the advent of the PC.

Behind the initiative's standard is the Mips R4000, a 64-bit microprocessor, and a choice of two new operating systems—a new OSF/1-based operating system from SCO and OS/2 3.0 from Microsoft. The standard also encompasses an architecture that combines Digital's Turbochannel bus with the PC industry's Expanded Industry Standard Architecture (EISA).

Binary compatibility across the different product lines will be guaranteed, say ACE members, with a standard based on Digital's method of ordering bytes. This byte-ordering scheme should aid in providing data compatibility not only with workstations but with the current installed base of personal computers, once compliant versions of Windows and New Technology OS, or OS/2 3.0, are available from Microsoft. That will be important for IS managers who plan to link workstations with their huge installed base of PCs, analysts say.

Beyond Binary Bugaboos

It may be too soon to tell how far this binary compatibility will go. Even though a number of companies have lined up to build what they say will be future software-compatible workstations using Mips chips, older systems incorporating Mips microprocessors are not likely to enjoy the same binary compatibility.

Mips's archrival, Sun Microsystems Inc., and the SPARC International user group have made considerable headway in the binary compatibility arena. SPARC International keeps a careful eye on Scalable Processor Architecture (SPARC) compatible manufacturers, testing and certifying machines and software for binary compatibility. As a result, Sun leads the workstation market today with approximately 30% market share, according to the San Jose-based market research firm Dataquest Inc. Sun hopes that its own and compatible systems will help it become the de facto standard for all workstations.

But Sun has yet to convince any major workstation vendor on the scale of Compaq Computer Corp., Digital or IBM to build SPARC-compatible systems (see "Sun Compatibles: Who's Putting The Sizzle In SPARC?" May 1, 1991, p.43). Most big computer companies seem leery of competing directly with Sun's engineering and marketing muscle. Indeed, Sun by far dominates the SPARC market today. Of the 160,000 SPARC systems expected to be shipped in 1991, less than 16% or 25,000 will come from non-Sun suppliers, predicts the market research firm Workgroup Technologies Inc. of Hampton, N.H.

MIPS MANUFACTURES its own line of systems and licenses its RISC design to others.

By focusing primarily on sales through OEMs and systems suppliers, Mips has avoided direct competition with systems vendors to a large degree. But, as its policy of soft-peddling its own workstations and servers changes, Mips may well find itself with Sun's problem, competing more directly with its own customers. Mips itself downplays this possibility. "The companies we sell to—Prime, Wang, Digital—they're used to competing with each other as minicomputer vendors. It's not like they have a new vendor to compete with," says Mips's Hime.

A Red Hot Design

Mips's customers are especially looking forward to the R4000, a new 64-bit RISC microprocessor that Mips says will ship at the end of this year. A third-generation chip, the R4000 includes a number of advances over its R3000 predecessor. These include built-in integer and floating-point processors, and superpipelining—a technique that speeds processing by allowing the chip to issue two instructions during each clock cycle. Other RISC chips issue a single instruction per cycle. As a result, Mips says, the R4000 will perform at 50 million instructions per second (MIPS). "That kind of power is attractive to companies that want to get into the competitive RISC marketplace," says Gartner Group's Gant. It's also a comfort to users like Winterhaven's Schell. "It's good to know [that Mips] has the technological wherewithal to compete, because it means they're a viable vendor," he says.

The R4000 announcement enters into a workstation world where the price/performance leader seems to change on a monthly basis. Currently, the performance leader seems to be Palo Alto-based Hewlett-Packard Co., which released the HP Apollo 9000 series 700 RISC workstations in March. Analysts say these systems leapfrog the competition in much the same way that IBM's RS/6000 leapfrogged Sun last year. HP's new entry-level model runs at 57MIPS, compared with IBM's RS/6000 model 320 at 29MIPS and Sun's SPARCstation 2 at 28MIPS.

Because the R4000 chip is still months away, at least some workstation suppliers have been forced to lower the prices of systems based on the older Mips R3000 in order to compete against newer generation workstations from the likes of HP. Digital—Mips's largest chip customer and according to most analysts the third largest supplier of workstations overall—is particularly vulnerable. According to a recent 1990/1991 DATAMATION/Cowen & Co. survey of DATAMATION readers, 30% of Digital workstation users are considering switching to other vendors because they are dissatisfied with the price of Digital's workstations. Perhaps for this reason, Digital in March lowered the price of its 16.2MIPS DECstation 3100 almost 30% from $6,995 to $4,995 and reduced the prices of other models by an average of $1,500.

Digital can probably be heard cheering about the Mips R4000 chip. If Mips has samples available by midyear, production of workstations based on the chip could begin by the end of the year, meaning system vendors like Digital could be shipping products by the middle of 1992.

One benefit of working with Mips, says Gartner Group's Gant, is that the company's products and services allow customers to cut their time to market considerably. For instance, Digital recently announced plans to use a new motherboard on its future RISC-based workstations and servers, which can be upgraded via a detachable CPU module. The design will ease the transition from the Mips R3000 processor to the new R4000 chip. The motherboard is expected to be included in workstations that Digital plans to introduce in the third quarter.

AMERICAN AIRLINE'S HOPPER: At the forefront of the downsizing trend

Despite being thought of as a chip design vendor, Mips actually has its largest market share in the world of RISC midrange systems—servers that are used more like traditional minicomputers than workstations. Unlike many proprietary minicomputers, however, most Mips-based midrange systems are based on UNIX. All can run any of approximately 1,100 third-party applications that Mips says have been ported from the proprietary world. "It surprises a lot of people, but that's where a lot of the growth is," Gant notes.

It's these minicomputer-like applications—many built on top of database packages from Informix Software Inc. of Menlo Park, Calif.; Ingres Corp. of Alameda, Calif.; and Oracle Corp. of Redwood Shores, Calif.—that Mips hopes will further open up the midrange market for RISC systems. "We believe that the midrange market is larger than the workstation market, and it's just beginning to take off," says Mips's Hime. Dataquest analyst Laura Segervall agrees. "That market is just beginning to grow," she says.

Up, Up And Away

As with other RISC chips, like Sun's SPARC, Mips chips are scalable. That is, they can be used to build everything from laptop-sized systems to multiprocessor mainframe-class systems. This lets Mips customers build networks of Mips-based systems, encompassing desktop systems, file servers and midrange systems, that can rival mainframes. Mips customers, in fact, visualize using such Mips systems to downsize existing mainframe applications to cheaper, faster platforms. Some are moving to multiprocessor midrange systems; others are opting for high-speed networks that distribute most of the processing power to the desktop.

That's what American Airlines Inc. had in mind when it recently decided to downsize and rework an old mainframe application. The subsidiary of Fort Worth, Texas-based AMR Corp. ported an IBM 3090 MVS/TSO mainframe application to a group of 12 Mips RS2030 workstations that are networked to a Mips RC3240 server. The division's Crew Allocation System now schedules flight crews for American's nine fleets, each of which has as many as 250 aircraft. The workstations run the RISC/os UNIX operating system and use the OSF/Motif graphical user interface.

According to Shane Batt, a senior consultant with American's Decision Technology Group, the Mips server acts as a communications gateway to American's IBM mainframe complex in Tulsa, Okla., which runs flight-scheduling, financial and other business applications. A primary benefit is that response time has been cut from nine hours to three. "Workstations handle mathematical optimization better," Batt says.

Applications like this will become ubiquitous in the future, believes American's senior vice president for information systems, Max D. Hopper. "Workstation vendors are providing tools that allow IS organizations to offload many of these mainframe applications," he says. And, indeed, they're also freeing up some land in Florida. ▭

This is the fourth in a series of articles focused on popular RISC-based platforms. DATAMATION next looks at high-end superworkstation systems.

Selected List of Mips Systems Suppliers

Computers that use Mips technology are available from Mips Computer Systems itself, from OEMs and from custom systems suppliers. Companies currently shipping products include the following:

Mips Systems/OEM Partners

MIPS Computer Systems Inc.
Sunnyvale, Calif.
Circle No. 300

Prime Computer Inc.
Natick, Mass.
Circle No. 301

Pyramid Technology Corp.
Mountain View, Calif.
Circle No. 302

Wang Laboratories Inc.
Lowell, Mass.
Circle No. 303

Custom Systems Using Mips Microprocessors

Digital Equipment Corp.
Maynard, Mass.
Circle No. 304

Sony Corp of America
New York City
Circle No. 305

Silicon Graphics Corp.
Mountain View, Calif.
Circle No. 306

Source: DATAMATION

Demand Solid, Budgets Soft

The latest DATAMATION/Cowen & Co. IS buying survey reveals a growing need for more mainframe MIPS and storage capacity, even as downsizing proceeds. But purchasing is being delayed.

BY JEFF MOAD

The mainframe is dead?

That's what we've been hearing for several years. First the downsizing of applications to networks of PCs was going to kill off the good old data center workhorse. More recently, client/server computing and a new generation of beefed-up UNIX-based multiprocessor systems were supposed to deliver the coup de grace to Big Iron.

And who could argue, especially since key mainframe vendors like Amdahl Corp. and IBM recently reported unexpectedly ugly financial results. Is it time to face facts, send out the funeral notices and acknowledge the death of the mainframe?

Not so fast, say the 2,487 executives and managers who responded to this spring's DATAMATION/Cowen & Co. computer industry survey. Although users' immediate plans for buying large systems were rocked early in the year by the recession and the Persian Gulf War, IS executives say their need for additional mainframe processing power and storage capacity will continue to grow at or above historical levels for at least the next three to five years. And, while it's true that many IS departments are downsizing mainframe-based applications to networked PCs and new client/server architectures, the survey says corporate users are shifting to the new technologies at a slow, measured pace.

User interest in buying any new technology, however, took a back seat to the outbreak of recession and war. Last November, in a separate DATAMATION/Cowen survey of user reaction to IBM's new ES/9000 mainframe, 16% of 43XX and 3090 users said they expected to spend "considerably more" on all types of processing hardware in the coming year, and only 10% said "considerably less." By February, however, with the recession firmly in place and Operation Desert Storm under way, only 13% said they would be spending considerably more, and a hefty 18% answered "considerably less."

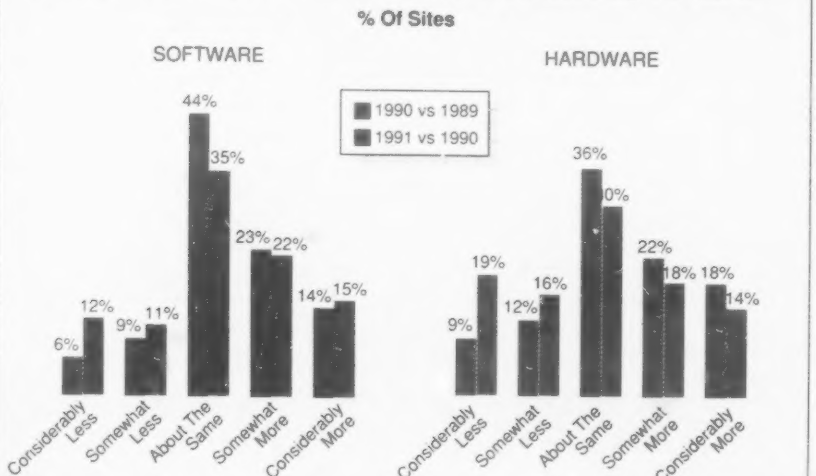
IS spending on software is projected to be slightly higher than on hardware in 1991, but even software spending is expected to be down from last year. Thirty-nine percent of large-system sites are expecting to spend somewhat or considerably more on software this year, compared with 44% last year.

Even once robust PC spending has been affected by the slowdown. Last year, 46% of users said they'd be buying more PCs in 1990 than they did in 1989; this year only 24%—just over half as many—said they'd be buying more PCs in 1991 than they did in 1990.

And downscaled spending plans aren't limited to IBM user organizations. While 35% of all IBM sites said their 1991 spend-

Total Hardware And Software Outlays Drop

How the dollar value of hardware (CPUs, peripherals and PCs) and software to be acquired in 1991 compares with that of 1990, and how 1990 compared with 1989.



Source: DATAMATION/Cowen & Co.

ing would be considerably less or somewhat less than it was in 1990, the figure for Unisys sites was 46%.

But, even though spending plans seem to be off across the board, IS executives say it's not because they don't need more hardware and software tools to get the job done. IS's need for increased PC, midrange and even mainframe capacity is up, even if the budget isn't there to accommodate it.

Mainlining MIPS

Over the next three to five years, in fact, survey respondents said their need for mainframe MIPS will grow by 23% per year. Their need for disk storage will grow by 27% per year. Both of those figures are slightly higher than the rate at which users saw their large-system capacity needs growing a year ago.

Driving those increasing capacity requirements are continuing lengthy application development backlogs and the adoption of new technologies, such as document and image processing. For example, 35% of the respondents from IBM 370-class mainframe shops said their current new application backlogs stretch out more than 24 months, and fully 80% have backlogs exceeding 12 months. In general, backlogs at large-systems shops are virtually unchanged from two years ago. The situation is worse for users of IBM midsized mainframes. Two years ago, 17% of those users said they had application development backlogs longer than two years. Today, 31% report two-year + backlogs.

As a way to attack those bulging backlogs, a growing number of IBM users seem to be buying into Big Blue's mainframe-based AD/Cycle computer-aided software engineering (CASE) solution. Forty-one percent of such users say they plan to use or evaluate AD/Cycle. That's up from 32% last year. Among current DB2 users, interest in AD/Cycle is even higher. Sixty-one percent of those users say they plan to use or evaluate AD/Cycle.

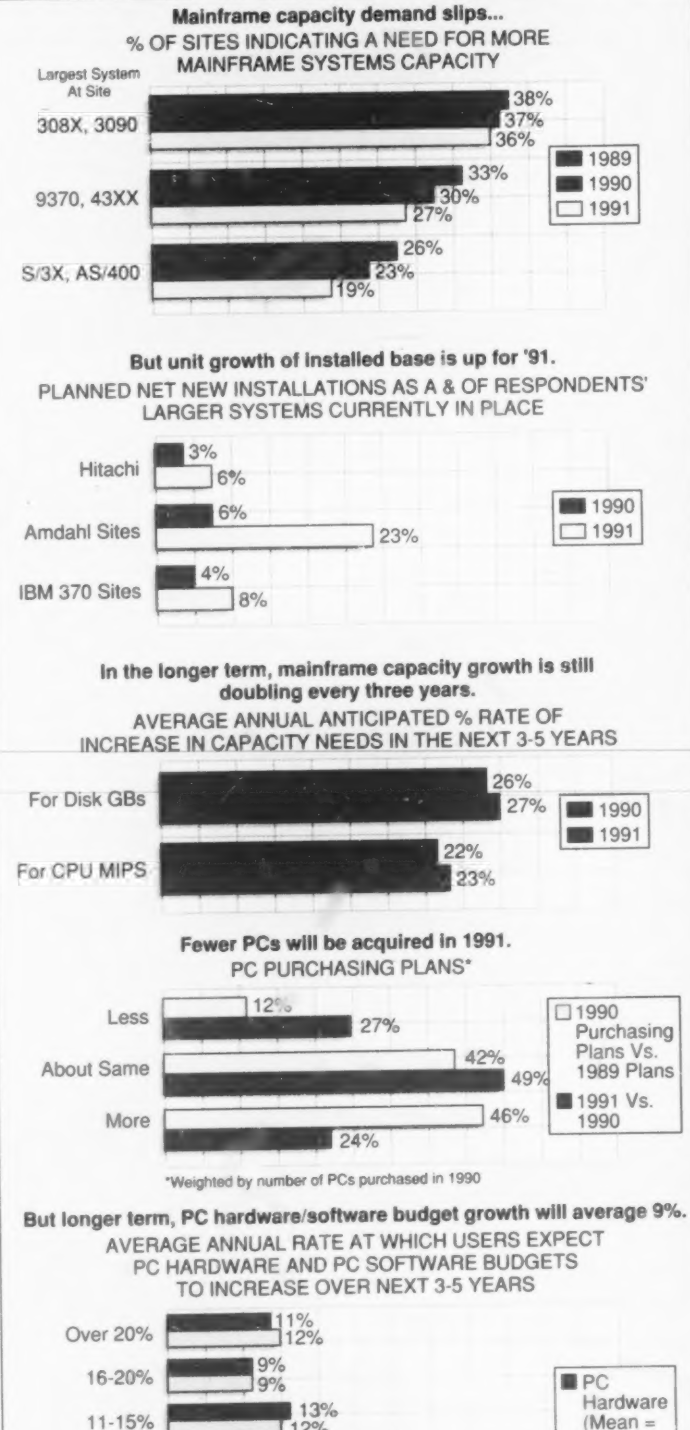
IBM's newest mainframe operating system, MVS/ESA, also is gaining strong user acceptance. Sixty-three percent of 3090 mainframe sites reported they have already converted to ESA or plan to do so this year. Widespread adoption of AD/Cycle and ESA should help increase demand for mainframe capacity.

Also continuing to spark mainframe demand is the growth of on-line transaction-processing applications. IS executives already running or planning to run OLTP applications said they expect the transaction load they'll be responsible for processing will grow at 19% per year for the next five years. Users say that growth rate is undiminished from what they've seen over the last five years.

The bulk of those OLTP applications will continue to run on IBM mainframes. Sixty-seven percent of the time IBM is mentioned as the current, and will be their future, OLTP hardware supplier.

Users are clearly looking to new OLTP technology suppliers, however. Massively parallel hardware vendor Teradata Corp. and UNIX supermini vendor Sequent Computer Systems Inc. each emerged in the survey to claim 2.7% of users' planned OLTP applications. Last year, Teradata attracted merely

The Big Picture For Mainframes, PCs



Source: DATAMATION/Cowen & Co.

1.4% of users and Sequent only 1.1%. Survey respondents indicate that Digital Equipment Corp.'s share of the OLTP market is dropping; currently 16% of respondents use DEC machines for OLTP, but only 12% expect to in the future. Tandem Computers Inc. is holding steady at about 5%.

IS executives also are clearly more interested than ever in client/server computing and UNIX, especially for departmental applications. Forty-five percent of respondents at sites with 1990 annual revenues over $250 million said they are either at the pilot stage or are starting to implement client/server systems. Acceptance is not nearly so great at smaller companies. At organizations with revenues under $50 million, only 22% of respondents are conducting pilot operations or starting to implement client/server computing.

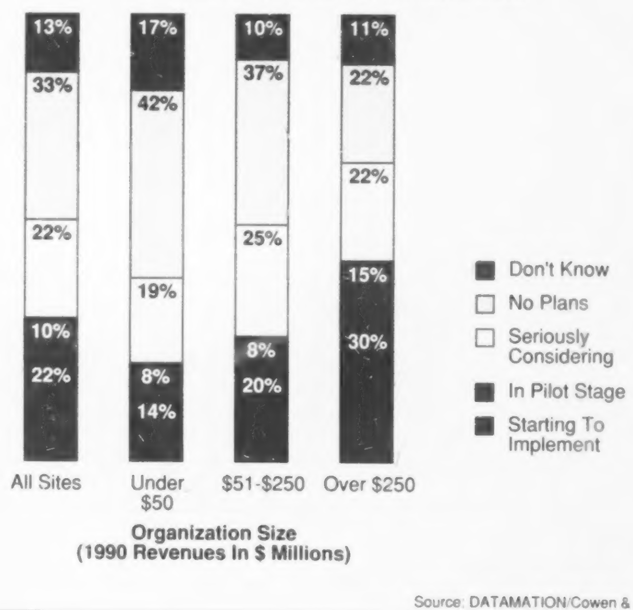
Customers aren't saying "no," they're saying "I don't know."

For their new client/server departmental applications, IS managers seem to be favoring both UNIX and OS/2. While IBM continues to be the primary departmental systems supplier for an overwhelming 91.6% of survey respondents, a collection of UNIX vendors also seems to be enjoying popularity with IS. IS executives indicating the strongest need for increased departmental systems capacity were those that identified AT&T, Digital, Hewlett-Packard Co., Sequent and Sun Microsystems Inc. as their primary suppliers. Among organizations evaluating, prototyping or implementing client/server architectures, 31% said they considered UNIX "very desirable." Only 13% of organizations with no client/server plans consider UNIX "very desirable." Among larger organizations, 24% said UNIX is the operating system they are most likely to use in implementing future new departmental systems.

Client-Server Computing Well Under Way

Fully 45% of the largest sites are implementing client/server computing.

CLIENT/SERVER IMPLEMENTATION PLANS



Source: DATAMATION/Cowen & Co.

But OS/2 is not far behind; 19% of large organizations plan to focus primarily on OS/2 for future new departmental systems. And 33% are targeting OS/2 for future new office systems. Users clearly consider OS/2-based relational database management systems from vendors such as IBM, Microsoft Corp. and Oracle Corp. as key to developing client/server architectures around desktop systems. While only 9% of survey respondents said they have an OS/2 client/server RDBMS (such as Microsoft/Sybase's SQL Server) installed today, 18% said they plan to have one working by 1992. IBM, with its OS/2 Data Manager, is emerging as the leading relational database vendor for client/server PC networks; 45% of potential users identified Big Blue as their supplier by 1992. SQL Server is coming on strong, however. Although only 7% are currently using the product, more than twice that number, 15%, plan to implement it by 1992.

PC Apps On The Rise

More client/server computing translates into more new applications on PCs and workstations. Last year, survey respondents said only 18% of their new applications would be implemented on PCs and/or workstations; this year that figure has risen to 24%. During the same period, the mainframe share of new applications dropped from 64 to 58%, while the mini's share remained at 18% in both surveys.

Longer term, IS executives said mainframes will continue to claim 49% of new applications compared with 32% for PCs and/or workstations and 19% for minicomputers. But 84% of IS managers tell DATAMATION that the proliferation of PC networks will increase mainframe workloads or have no effect on them; 85% said the same thing last year.

And, for new distributed-processing applications in particular, the mainframes have a slight edge over minis. Reports of the percentage of stand-alone or networked PCs and workstations being used as the principal platform for distributed-computing applications has risen sharply from 39% in 1990 to 48% in this year's survey. At the same time, the number of sites citing the mainframe as the principal distributed-computing platform dropped from 39 to 34%. But the percentage using minis for that purpose dropped even more steeply, from 22% in last year's survey to 18% in this year's.

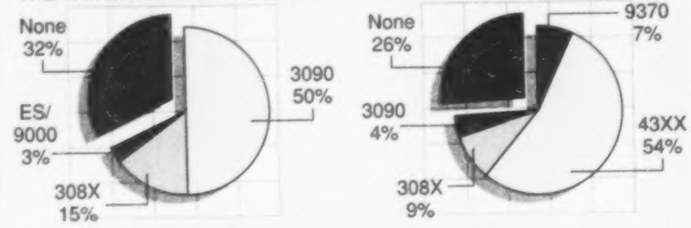
Still, for now, continued economic uncertainty and lower IS budget growth are forcing IS executives to take a conservative approach to their immediate mainframe purchasing plans.

"[Customers] aren't saying 'no,' they're saying, 'I don't know,' " says IBM Data Systems division president Nicholas M. Donofrio. For example, although Donofrio says industry and customer response to IBM's new ES/9000 generation of mainframes introduced last fall has been positive, he acknowledges that orders have not been meeting expectations. He

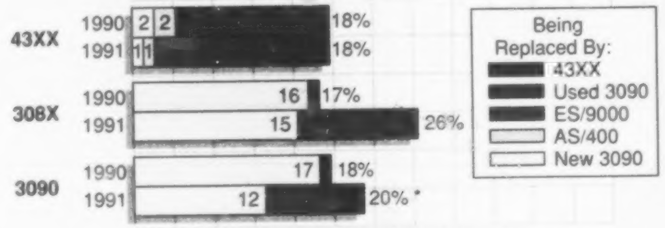
How IBM Is Doing With The S/390

One-third of water-cooled systems are new business...
SYSTEMS BEING REPLACED BY THE WATER-COOLED ES/9000S

And one-fourth of air-cooled ES/9000s are new.
SYSTEMS BEING REPLACED BY THE AIR-COOLED ES/9000S

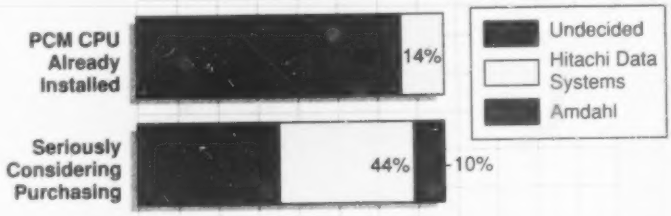


Nevertheless, there's still plenty of life in the 3090.
% OF CURRENTLY INSTALLED SYSTEMS SLATED TO BE REPLACED
(370-Compatible Systems Only)

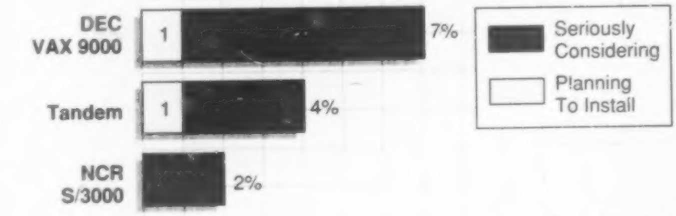


*Subtotals may not add up to totals due to rounding

Hitachi Stings Amdahl
POTENTIAL PROGRAM-COMPATIBLE CPU SUPPLIER CITED AMONG 3090-CLASS USERS



DEC and Tandem Make Modest Inroads
% OF SITES CONSIDERING NONPROGRAM-COMPATIBLE ALTERNATIVES FOR THEIR NEWER HOST-BASED APPLICATIONS
(308X/3090-Class Sites Only)



Source: DATAMATION/Cowen & Co.

attributes that to longer buying cycles brought on by economic uncertainty.

Many IS organizations are leaning toward upgrading their existing 3090-class systems or even buying used equipment before bringing in new ES/9000 hardware. Current 3090 users plan to replace 20% of their large systems in 1991; 14% will give way to upgraded 3090s or 3090s purchased from the used market. Only 7% will be replaced by new ES/9000 machines.

The low rate at which ES/9000s seem to be replacing 3090s reflects a couple of trends. First, since IBM has been pushing users to purchase rather than lease its big iron, most 3090 users own their machines. That makes them more reluctant to replace what they have and more likely instead to upgrade and expand their already installed systems. Second, few users are currently strapped for 3090 power. The survey shows that only 27% of 3090 model E, J and S users have maxed out to five or six-processor complexes. In fact, nearly half are still at one or two processors.

IS also is taking a conservative approach when it comes to migrating to IBM's next generation of mainframe disk storage devices, the 3390s. Of those large disk subsystems to be purchased in 1991, more than half will still be of the previous generation 3380 class. That figure is virtually unchanged from last year.

A Superior Machine

Not that mainframe users aren't enthusiastic about IBM's new mainframe offerings. Users of IBM midsized mainframes have enthusiastically purchased the new ES/9000 air-cooled systems. And the survey shows that users of all classes of 3090 mainframes rated the high-end ES/9000 superior in new functionality and availability compared with competing machines from Amdahl and Hitachi Data Systems Corp. IS, not surprisingly, prefers the plug-compatible offerings for price/performance.

The strong showing of the ES/9000 has placed some added pressure on the plug-compatible manufacturers. Only 21% of IBM mainframe customers surveyed who have not yet installed a PCM system said they are seriously considering one this year. That's down sharply from 26% in last year's survey.

Mainframe users seem particularly skeptical about Amdahl's ability to respond to the ES/9000. Among those who are seriously considering a switch to a PCM mainframe supplier, only 46% identified Amdahl as their likely supplier, versus the 44% who named HDS. That's a switch in the large-scale PCM market, where Amdahl controls about 86% of the PCM systems already installed to HDS's 14%.

Neither IBM nor HDS can rejoice just yet over positive customer response to their new mainframe products, however. First, IS must perceive some improvement in overall economic conditions, at least enough to loosen IT purchasing purse strings.

The survey indicates that eventually they will. IS executives said their hardware budgets will grow by 7.1% per year over the next three to five years. That's up slightly from the 6.9% figure they gave last year. And the long-term picture is even brighter for PC hardware and software budgets. The average annual IS budget growth rate for both PC hardware and software is expected to hover just over 9% for the next three to five years.

The question for many vendors is: When will users reopen the spending spigot? When they do, vendors will have to do what they can to make up for lost time. "I don't know if you can do 12 months of business in nine months," IBM's Donofrio says. "But I haven't changed anyone's quota." ▭

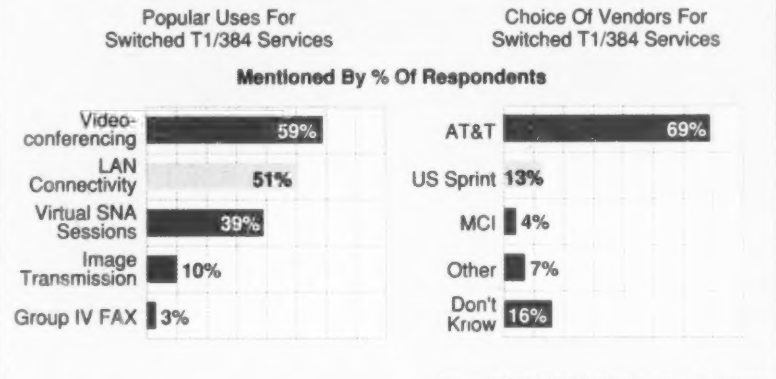
MARKET INSIGHTS

A SURVEY OF TECHNOLOGY TRENDS

Switched T1 Is The Coming Thing

BY WARREN CHILDS
Business Research Group

Who's Pulling The Old Switcheroo



Source: DATAMATION, Business Research Group

A surprisingly strong 29% of our readers are now or are planning to begin dialing up the public network to tap into switched T1 and 384-kilobit-per-second communications services for their wide-bandwidth communications needs, according to the most recent survey of the DATAMATION Technology Panel. The survey shows that 16% of panel members have already begun using switched T1 services and 384Kbps service, and an additional 13% plan to do so.

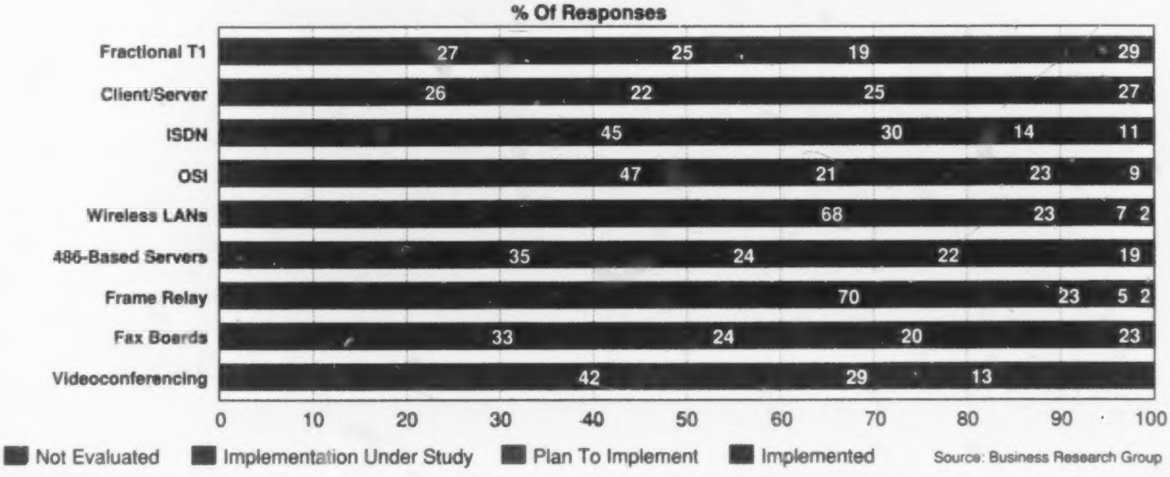
Although the cost of full-time leased lines for T1 services has dropped dramatically in recent months, so far only a few large corporations that have a consistently great need for it are signing up for this wide-bandwidth service. Many more companies have begun to implement applications that require bandwidth in multiples of 64Kbps, but for applications that are sporadic and don't justify leasing full-time T1 capacity. Demand for these occasional uses—which include videoconferencing, LAN-to-LAN connectivity and image transmission—is spurring the creation of a wide range of services from network carriers. These include fast packet switching, Switched Mutimegabit Data Sources (SMDS), Integrated Services Digital Network (ISDN), software-defined networks—and switched T1 services.

Switched T1 service and switched 384Kbps service allow users to dial up access to high-bandwidth service through the public network, removing the need to lease full-time private lines. AT&T was the first carrier to offer switched T1 and 384Kbps service; MCI Communications Corp. and US Sprint Communications Co. are now beginning to make this service more widely available, too.

For more information, call Nancy Finn at (617)-964-6204, fax her at (617)-558-4402 or write to her at the Business Research Group, 275 Washington Street, Newton, MA 02158.

DATAMATION's Technology Implementation Index: Networks/Communications

DATAMATION each month surveys a select group of its readers—the DATAMATION Technology Panel— to investigate the implementation of new technologies by key user organizations.



Source: Business Research Group

SPECIAL ISSUE: World IT Sales Grow 9% To $279B

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A CAHNERS PUBLICATION

DATAMATION®

FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE

PERIPHERALS
MIDRANGE
DATACOM
MAINTENANCE
WORKSTATIONS
LARGE-SCALE SYSTEMS
SOFTWARE
PERSONAL COMPUTERS
SERVICES

JUNE 15, 1991

THE DATAMATION 100

The Top 100 Suppliers Worldwide *page 11*

The Top 100 North American Suppliers *page 12*

Profiles of the Top 100 North American Suppliers page 28

With Scorecards On The Best In:

* **Personal Computers**
* **Workstations**
* **Large-Scale Systems**
* **Data Communications**
* **Midrange**
* **Software**
* **Peripherals**
* **Services**
* **Maintenance**

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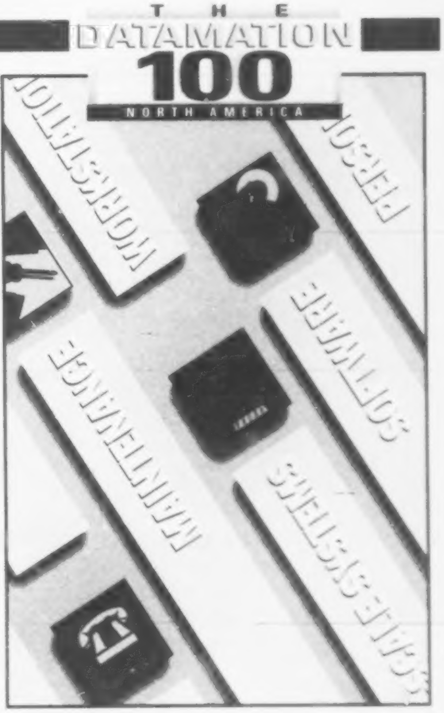
INSIGHTS FROM OVER 100 EXECUTIVES

VOLUME 37 JUNE 15, 1991 NUMBER 12

DATAMATION

FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE

COVER STORY



World IT Sales Grow 8.9% To $278.5B; North America Hits $184.7B

BY JOSEPH KELLY Despite the recession, the top 100 North American information technology suppliers grew their PC, midrange, workstation, software and services businesses at a healthy clip in 1990. But sellers of mainframes and datacom equipment hit the skids. **PAGE 10**

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An Expanded DATAMATION 100

The year 1990 marks the 10th anniversary of the DATAMATION 100 and the 15th year of the magazine's efforts to measure the information technology industry. In 1976, DATAMATION began ranking the top 50 U.S. suppliers of information technology. In 1980, we doubled the number of U.S. companies ranked and profiled annually, thereby creating what has become an institution: The DATAMATION 100. Five years later, in 1985, DATAMATION expanded the exercise worldwide and for the first time covered European and Japanese suppliers.

This year, we once again expand the famous franchise by profiling 100 U.S. companies and 50 overseas companies. We will present this DATAMATION 100 research in three parts:

- This Issue: The DATAMATION 100: The Top 100 Worldwide Suppliers
  The Top 100 North American Suppliers
  Profiles of the Top 100 North American Suppliers
- July 1: The European 25: The Top 25 European IT Suppliers
  Profiles of the Top 25 European Suppliers
- September 1: The Asian 25: The Top 25 Asian IT Suppliers
  Profiles of the Top 25 Asian Suppliers

How We Count The Beans

All figures are for calendar year 1990. For companies operating on a fiscal year that doesn't coincide with the calendar year, DATAMATION either compiles quarterly information or relies on the estimates of the companies themselves or industry analysts. DATAMATION also allows companies to restate the previous year's figures. We do not include revenues from basic data transmission services, stand-alone typewriters or cash registers, instrumentation, semiconductors, printed circuit boards, automatic test equipment, supplies (with the exception of magnetic media), industrial control devices, central office telephone switches, analog PBXs or computer-output micrographic systems.

Currencies for foreign companies are computed based on the 1990 floating year figure provided by the Organization for Economic Cooperation and Development.

With Thanks

Over the last five years, the efforts of New York City-based freelancer Joe Kelly have been invaluable. Once again this year, Joe has served as strategist, overview and profile writer and overall guidance counselor.

With Joe in the control tower has been our editorial researcher Susan Mael, who over the past three months has spent countless hours on the phone and in front of the fax machine persuading companies to send in their financial data.

Providing critical assistance with Asian-based company financial data was Hugo X. Hsiung, an editor with our sister publication *Electronic Business Asia*. We are indebted to him for his able service.

And last, but certainly not least, DATAMATION wishes to acknowledge and thank Gary M. Fishman, a consultant for Commodore International Ltd., who has adapted a hypertext program designed specifically for the DATAMATION 100.

Mr. Fishman has put a template of our questionnaire on floppy disk, which we are sending to the 250 or so companies we research for this project, so that they may keep a running account of their activities over the year. The menu-driven program can run on any 286 PC or higher. In addition to providing a convenient way to record the financial statistics we gather each year, the program also offers opportunities to include a corporate summary, quarterly financial information, new product releases and organizational changes as they occur throughout the year.

Steve Paul, Managing Editor

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World IT Sales Grow 8.9% To $278.5B

North America Hits $184.7B

Despite the recession, the top 100 North American information technology suppliers grew their PC, midrange, workstation, software and services businesses at a healthy clip in 1990. But sellers of mainframes and datacom equipment hit the skids.

BY JOSEPH KELLY

Even before the drum beats heralded the onset of war last August, you could already hear the sound of the last eight years of economic growth coming to a screeching halt.

A morass of bank failures, sluggish housing starts and lackluster auto sales helped push the U.S. economy into a recession. Layoffs and downsizing were the order of the day. In Europe, not even a reunited Germany and the prospect of a more unified, post-1992 pan-European market could overcome weakened consumer and capital spending. And in Japan, higher interest rates plus the wounded stock and real estate markets took some of the glow off the country's still impressive economic machine.

But, like so much else, this first recession of the post-Cold War world is marching down its own path. Unlike in the recessions of 1982 or 1973, capital spending is being trimmed, not trashed. And surveys by both the U.S. Commerce Department and Dun & Bradstreet Corp. show slim signs of recovery. Both project slight increases in inflation-adjusted capital spending for 1991. This is consistent with DATAMATION's latest IS budget survey, which indicates 1991 budgets rising a slight 3.4%. However, even though the prime lending rate has dropped, bank lending remains conservative, which does not bode well for future growth.

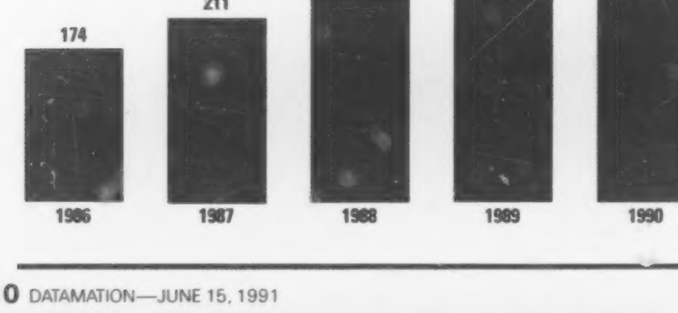
This good news/bad news scenario is echoed in the U.S. economy's various industrial sectors. Manufacturing companies by and large entered this recession in better shape than they did the last time around, having spent much of the 1980s modernizing and slashing payrolls. This means they will be ready to profit quickly when the economy turns up again. Some companies may not feel the recession at all. But service companies—from airlines and advertising to telecommunications firms and the brokerage houses that line Wall Street—are finding this recession a real bear.

The Dynamics Of IT

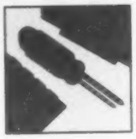
The IS industry has always been considered resistant to recessions and, arguably, the conventional wisdom still holds true. The figures compiled for this year's DATAMATION 100, which ranks the leading IS companies based on their calendar year sales, show an industry that, in its fifth decade, still retains the trappings of growth. It is an industry still able to create products and services that hold their appeal whatever the economic climate. In total, the IS revenues of the world's top 100 IS companies grew 8.9% to $278.5 billion, not a bad showing compared with the 5.3% growth of 1989. Buoyant sales of workstations, peripherals (primarily storage devices and laser printers), software and services boosted the revenues of those companies quick and wise enough to jump into those fast-growing arenas.

And So IT Grows

Revenues from the DTM 100 climbed more than $100 billion over the past five years.



The weak dollar also helped U.S. companies boost sales overseas, while limiting the appeal of imported products in the United States. Revenue for the top 100 U.S. and Canadian companies, which are profiled



in this issue, rose 10.5% over 1989's level to $184.7 billion. That's also a jump from 1989, in which the revenues of the top 100 North American companies climbed only 5.9% higher than 1988. And net earnings for the top 100 North American firms in 1990 rose 8.1%, a welcome relief from the 8.3% earnings drop suffered in 1989.

Topping the growth list this year were workstation sales, which soared 34.7% in 1990. This growth is primarily a reflection of the tremendous success of IBM's RS/6000 line, which more than doubled in sales to around $1 billion, and a 33% increase in sales at Sun Microsystems Inc.

Revenue from peripheral devices, which account for one out of every five dollars received by the top 100 North American IS vendors, rose 18.9% in 1990. The growth in peripherals came from companies like Conner Peripherals and Quantum, which did well in microcomputer disk drives. IBM and Storage Technology Corp. also enjoyed strong demand for their mainframe storage products. Hewlett-Packard Co. continued to see healthy sales of its laser printers.

Sales of personal computers by North American firms broke the $25 billion mark and now account for 14% of the top 100 North American vendors' revenues. But the 12.6% growth in PC sales in 1990 is a far cry from the stunning growth patterns of the mid-1980s and reflects the raging price war being led by Apple Computer Inc., AST Research Inc. and Dell.

In general, the current recession has probably had the effect of delaying or canceling purchases of larger scale systems. As a result, the dollar volume generated by mainframe sales in 1990 fell 10.1% to $14.4 billion. IBM's sales of mainframes dropped some 12% from $12.1 billion to $10.6 billion, while Amdahl's sales declined over $100 million to $1.36 billion. Both drops were due in part to customers anticipating new products slated for introduction this year.

The Open Question

While the effects of the recession spread unevenly through the industry last year, another force was moving relentlessly in the background. Over the last two years, the trend toward open systems has had a profound effect on older hardware manufacturers, such as Data General Corp., Digital Equipment Corp., IBM, Prime Computer Inc., Unisys Corp. and Wang Laboratories Inc. The pricing of open systems products undercuts the margins these companies were formerly able to obtain on their proprietary systems. But the organizational structures of these firms are characterized by large direct sales and support forces, which had been supported by the big profits that the

Text continued on page 16

The DATAMATION 100

WORLD RANK			
'90	'89	COMPANY	REVENUE*
1	1	IBM	67,090.0
2	2	Digital	13,072.3
3	4	Fujitsu	12,361.5
4	3	NEC	12,350.3
5	6	Hitachi	9,590.9
6	5	Unisys	9,302.0
7	7	Hewlett-Packard	9,300.0
8	N/A	Siemens/Nixdorf	7,735.1
9	10	Olivetti	6,414.5
10	8	Groupe Bull	6,349.6
11	11	Apple	5,740.0
12	12	NCR	5,617.0
13	13	Toshiba	4,764.5
14	14	Canon	4,669.2
15	15	Matsushita	3,731.0
16	16	Compaq	3,598.0
17	18	NV Philips	3,283.9
18	17	AT&T	2,900.0
19	23	EDS	2,870.0
20	N/A	ICL	2,862.9
21	20	Xerox	2,800.0
22	27	Sun	2,762.8
23	34	Seagate	2,667.6
24	21	Wang	2,363.0
25	25	Nihon Unisys	2,279.0
26	26	Amdahl	2,158.8
27	24	NTT	2,114.0
28	29	Mitsubishi	2,055.5
29	30	Oki	1,989.0
30	28	Memorex-Telex	1,951.2
31	32	Alcatel	1,890.0
32	37	Tandem	1,873.1
33	38	TRW	1,852.0
34	33	Ricoh	1,774.3
35	45	Andersen Consulting	1,748.4
36	36	ADP	1,730.0
37	48	Cap Gemini	1,684.9
38	41	CSC	1,679.3
39	42	C. Itoh	1,595.1
40	40	Seiko Epson	1,590.7
41	39	Prime	1,589.0
42	50	Microsoft	1,480.0
43	60	Conner Peripherals	1,337.5
44	44	Computer Associates	1,310.7
45	46	Nokia	1,279.9
46	43	Data General	1,237.4
47	47	Northern Telecom	1,220.0
48	31	Tandy	1,214.7
49	49	StorageTek	1,141.0
50	35	Control Data	1,121.9
51	57	Oracle	1,058.9
52	52	Intergraph	1,044.6
53	51	Commodore	995.7
54	55	Intel	980.0
55	53	Motorola	954.0
56	54	Mannesmann	893.2
57	61	3M	875.0
58	64	Finsiel	861.2
59	65	American Express	827.0
60	56	Cray	804.4
61	58	General Electric	800.0
62	81	Maxtor	789.4
63	62	British Telecom	776.8
64	75	Acer	751.0
65	91	Quantum	716.3
66	67	Texas Instruments	700.0
67	68	Racal	693.0
68	N/A	Tatung	693.0
69	63	Black & Decker	692.1
70	69	Comparex	689.4
71	70	Lotus	684.5
72	74	NYNEX	618.0
73	71	SHL	599.0
74	76	AST Research	586.5
75	77	Science Applications	569.0
76	72	CSK	553.9
77	73	Martin Marietta	549.4
78	93	Dell	546.0
79	79	D&B Software	539.0
80	95	Sema Group	533.4
81	89	Sligos	530.7
82	59	Amstrad	518.7
83	84	Novell	497.5
84	66	Lockheed	494.0
85	80	Ernst & Young	490.0
86	101	Silicon Graphics	482.1
87	N/A	Western Digital	460.2
88	78	Wyse	460.0
89	83	SD-Scicon	455.6
90	117	WordPerfect	452.4
91	94	Mitac	440.0
92	87	3Com	437.0
93	85	Mentor	435.2
94	97	Kyocera	433.3
95	88	Everex	427.6
96	96	Tandon	421.8
97	103	Stratus	403.9
98	86	Alps	403.3
99	92	Shared Medical	403.1
100	115	McDonnell Douglas	398.0

* All revenue figures are in $ millions.

The DATAMATION North American 100

1990 US RANK	1989 US RANK	1989 WORLD RANK	COMPANY	1990 IS REV.	1989 IS REV.	IS REV. % CHANGE	1990 TOTAL REV.	IS AS % OF TOTAL REV.	NET EARNINGS
1	1	1	IBM	67,090.0	60,805.0	10.34%	69,018.0	97.21%	6,020.0
2	2	2	Digital	13,072.3	12,936.7	1.05%	13,072.3	100.00%	-94.5
3	3	6	Unisys	9,302.0	9,390.0	-0.94%	10,111.0	92.00%	-437.0
4	4	7	Hewlett-Packard	9,300.0	7,800.0	19.23%	13,233.0	70.28%	739.0
5	5	11	Apple	5,740.0	5,372.3	6.84%	5,740.0	100.00%	500.6
6	6	12	NCR	5,617.0	5,319.0	5.60%	6,178.7	90.91%	369.0
7	7	16	Compaq	3,598.0	2,876.1	25.10%	3,598.0	100.00%	454.9
8	8	18	AT&T	2,900.0	2,865.0	1.22%	37,285.0	7.78%	2,735.0
9	11	19	EDS	2,870.0	2,477.9	15.82%	6,108.8	46.98%	496.9
10	9	21	Xerox	2,800.0	2,790.0	0.36%	17,973.0	15.58%	243.0
11	13	22	Sun	2,762.8	2,062.5	33.96%	2,762.8	100.00%	151.0
12	15	23	Seagate	2,667.6	1,797.0	48.45%	2,667.6	100.00%	99.7
13	10	24	Wang	2,363.0	2,697.0	-12.38%	2,363.0	100.00%	-665.4
14	12	26	Amdahl	2,158.8	2,101.0	2.75%	2,158.8	100.00%	184.0
15	18	32	Tandem	1,873.1	1,676.8	11.71%	1,873.1	100.00%	98.1
16	19	33	TRW	1,852.0	1,643.0	12.72%	8,169.0	22.67%	208.0
17	24	35	Andersen Consulting	1,748.4	1,225.7	42.65%	1,880.0	93.00%	N/A
18	17	36	ADP	1,730.0	1,689.5	2.40%	1,750.0	98.86%	250.0
19	21	38	CSC	1,679.3	1,442.8	16.39%	1,679.3	100.00%	68.0
20	20	41	Prime	1,589.0	1,518.0*	4.68%	1,589.0	100.00%	19.0
21	27	42	Microsoft	1,480.0	952.8	55.33%	1,480.0	100.00%	355.6
22	35	43	Conner Peripherals	1,337.5	704.9	89.74%	1,337.5	100.00%	62.8
23	23	44	Computer Associates	1,310.7	1,290.1	1.60%	1,310.7	100.00%	162.0
24	22	46	Data General	1,237.4	1,314.4*	-5.86%	1,237.4	100.00%	-119.3
25	25	47	Northern Telecom	1,220.0	1,150.0	6.09%	6,768.7	18.02%	460.2
26	14	48	Tandy	1,214.7	980.3*	23.91%	4,648.1	26.13%	261.3
27	26	49	StorageTek	1,141.0	982.5	16.13%	1,141.0	100.00%	69.0
28	16	50	Control Data	1,121.9	2,900.0*	-61.31%	1,691.0	66.35%	2.7
29	33	51	Oracle	1,058.9	769.3	37.64%	1,058.9	100.00%	57.4
30	29	52	Intergraph	1,044.6	860.1	21.45%	1,044.6	100.00%	62.6
31	28	53	Commodore	995.7	866.5	14.91%	995.7	100.00%	40.2
32	31	54	Intel	980.0	812.0	20.69%	3,921.0	24.99%	650.0
33	30	55	Motorola	954.0	860.0	10.93%	10,885.0	8.76%	499.0
34	36	57	3M	875.0	735.0*	19.05%	13,021.0	6.72%	1,308.0
35	38	60	American Express	827.0	660.0	25.30%	24,332.0	3.40%	181.0
36	32	61	Cray	804.4	784.7	2.51%	804.4	100.00%	113.0
37	34	62	General Electric	800.0	740.0	8.11%	58,400.0	1.37%	4,300.0
38	50	63	Maxtor	789.4	447.2	76.52%	789.4	100.00%	10.8
39	57	66	Quantum	716.3	394.2	81.71%	716.3	100.00%	66.7
40	40	67	Texas Instruments	700.0	585.0	19.66%	6,567.0	10.66%	-39.0
41	37	70	Black & Decker	692.1	687.6	0.65%	4,832.3	14.32%	51.1
42	41	72	Lotus	684.5	556.0	23.11%	684.5	100.00%	23.3
43	44	74	NYNEX	618.0	495.0	24.85%	13,585.0	4.55%	949.4
44	42	75	SHL	599.0	539.8	10.97%	599.0	100.00%	-35.0
45	45	76	AST Research	586.5	482.0	21.68%	586.5	100.00%	52.5
46	46	77	Science Applications	569.0	479.0	18.79%	1,163.0	48.93%	33.3
47	43	79	Martin Marietta	549.4	502.2	9.40%	6,125.9	8.97%	327.6
48	59	80	Dell	546.0	388.6	40.50%	546.0	100.00%	27.2
49	48	81	D&B Software	539.0	450.0	19.78%	4,800.0	11.23%	508.0
50	52	85	Novell	497.5	429.9	15.72%	497.5	100.00%	94.3

All revenue figures are in $ millions
*Revenue figure restated
N/A = Not available

The DATAMATION North American 100

1990 US RANK	1989 US RANK	1989 WORLD RANK	COMPANY	1990 IS REV.	1989 IS REV.	IS REV. % CHANGE	1990 TOTAL REV.	IS AS % OF TOTAL REV.	NET EARNINGS
51	39	86	Lockheed	494.0	590.0	-16.27%	9,958.0	4.96%	335.0
52	49	87	Ernst & Young	490.0	450.0	8.89%	5,000.0	9.80%	N/A
53	63	88	Silicon Graphics	482.1	343.0	40.55%	482.1	100.00%	39.8
54	N/A	89	Western Digital	460.2	N/A	N/A	1,068.8	43.06%	-78.6
55	47	90	Wyse	460.0	452.3	1.70%	460.0	100.00%	N/A
56	74	92	WordPerfect	452.4	281.4*	60.77%	452.4	100.00%	N/A
57	54	94	3Com	437.0	413.9	5.58%	437.0	100.00%	24.0
58	53	95	Mentor	435.2	426.4	2.06%	435.2	100.00%	23.6
59	55	97	Everex	427.6	402.0	6.37%	427.6	100.00%	-0.8
60	60	98	Tandon	421.8	377.9	11.62%	421.8	100.00%	25.6
61	65	99	Stratus	403.9	341.3	18.34%	403.9	100.00%	37.0
62	58	101	Shared Medical	403.1	390.0	3.36%	403.1	100.00%	22.7
63	72	102	McDonnell Douglas	398.0	390.0*	2.05%	16,255.0	2.45%	15.0
64	56	105	MAI Systems	389.5	397.0	-1.89%	389.5	100.00%	-64.5
65	N/A	106	Software AG	389.0	294.9	31.91%	389.0	100.00%	N/A
66	68	108	Micropolis	381.0	307.0	24.10%	381.0	100.00%	8.0
67	70	110	Price Waterhouse	370.0	305.0	21.31%	2,900.0	12.76%	N/A
68	67	111	Bell Atlantic	350.0	320.0	9.38%	12,298.0	2.85%	1,312.5
69	80	114	Diebold	328.4	243.8	34.70%	476.1	68.98%	27.1
70	64	115	Atari	325.7	374.5*	-13.03%	411.5	79.16%	14.9
71	61	116	Boeing	320.0	359.2	-10.91%	28,043.0	1.14%	448.0
72	51	117	Kodak	320.0	445.0	-28.09%	18,908.0	1.69%	703.0
73	62	119	Concurrent	296.0	345.0*	-14.20%	296.0	100.00%	-60.0
74	73	120	Tektronix	291.4	287.5*	1.36%	1,395.9	20.88%	-70.1
75	69	121	Gerber Scientific	279.8	306.1	-8.58%	279.8	100.00%	32.4
76	76	122	Policy Management	272.0	205.4*	32.42%	346.1	78.59%	37.2
77	71	123	Datapoint	265.6	299.0	-11.17%	265.6	100.00%	-66.7
78	85	125	American Management	261.9	225.3	16.25%	261.9	100.00%	10.4
79	88	126	Systematics	255.0	224.0*	13.84%	255.0	100.00%	N/A
80	82	127	Reynolds & Reynolds	252.0	253.2*	-0.47%	595.3	42.33%	24.4
81	93	128	ASK Computer	249.7	189.6*	31.70%	249.7	100.00%	4.7
82	N/A	129	Sequent	248.8	145.6	70.91%	248.8	100.00%	18.8
83	75	130	National Data	244.6	275.7	-11.28%	244.6	100.00%	5.5
84	83	131	Computer Task Group	243.9	233.0	4.68%	243.9	100.00%	7.2
85	90	132	SAS Institute	240.2	205.6	16.83%	240.2	100.00%	N/A
86	96	133	Autodesk	237.9	178.6	33.20%	237.9	100.00%	56.8
87	79	134	Recognition Equipment	230.6	255.9*	-9.89%	230.6	100.00%	-31.7
88	77	135	Ashton-Tate	230.5	265.3	-13.12%	230.5	100.00%	-18.1
89	84	136	Pansophic	230.0	196.4*	17.09%	232.2	99.05%	-14.3
90	N/A	138	Coopers & Lybrand	221.0	140.0	57.86%	4,100.0	5.39%	N/A
91	100	139	Cadence	216.7	145.2*	49.24%	231.4	93.63%	38.0
92	98	141	Convex	209.3	158.6	31.97%	209.3	100.00%	18.4
93	97	142	Cincom	207.7	165.1*	25.80%	207.7	100.00%	N/A
94	95	143	Sterling	207.0	184.4*	12.26%	207.0	100.00%	12.4
95	78	144	Bolt Beranek & Newman	204.3	236.2*	-13.49%	261.9	78.00%	-34.8
96	91	145	HBO & Co.	201.5	203.6	-1.03%	201.5	100.00%	7.1
97	N/A	146	Pyramid	200.5	114.4	75.19%	200.5	100.00%	18.4
98	92	147	General DataComm	199.4	201.2	-0.89%	199.4	100.00%	-0.3
99	89	148	Ultimate	196.9	206.5	-4.64%	196.9	100.00%	125.0
100	N/A	149	Information Builders	190.0	160.0	18.75%	190.0	100.00%	N/A

All revenue figures are in $ millions
*Revenue figure restated
N/A = Not available

Fast Trackers

The companies that grew the most in 1990.

	COMPANY	1990 IS REVENUE	1989 IS REVENUE	% INCREASE
1	Conner Peripherals	1,337.5	704.9	89.74%
2	Quantum	716.3	394.2	81.71%
3	Maxtor	789.4	447.2	76.52%
4	Pyramid	200.5	114.4	75.19%
5	Sequent	248.8	145.6	70.91%
6	WordPerfect	452.4	281.4	60.77%
7	Coopers & Lybrand	221.0	140.0	57.86%
8	Microsoft	1,480.0	952.8	55.33%
9	Cadence	216.7	145.2	49.24%
10	Seagate*	2,667.6	1,797.0	48.45%

All revenue figures in millions.
*Revenue change due to merger

proprietary systems used to command. These computer makers are finding such structures to be ill-adapted to the new high-volume, low margin economic model.

One response has been consolidation and restructuring, amply evident last year. Witness the mergers of Siemens AG and Nixdorf Computer AG in Germany; Fujitsu Ltd.'s purchase of the struggling U.K. mainframe company, International Computers Ltd.; and the AT&T/NCR Corp. merger. In each case, consolidation was spurred by the need for greater scale to overcome weaker margins. A company has to be big enough to spread the costs of marketing and R&D over a broad product line.

The pending AT&T/NCR deal is a prime example of the trend. By all rights, AT&T, which invented UNIX, should be riding high today. But it lacked the computer industry marketing experience and the organization it needed, and it failed to turn a profit in any of the six years since divestiture. In buying NCR, AT&T gets an old-line IS manufacturer that successfully reoriented its product line toward open systems products, but that would have been hard pressed to muster the large scale needed to survive the lowered margins these products bring.

By intensifying the existing pressure on hardware profits, the recession is bringing into sharper focus a new competitive structure in IS that centers around the following:

- **A humbled but still dominant IBM.** In 1989, IBM lost money on its U.S. sales and was forced to bite the bullet with a $2.3 billion restructuring. Big Blue reaped the benefits in 1990 with a solid $6 billion in earnings. With a new line of mainframes on the market, and very competitive midrange and workstation offerings, IBM has strong products in key market sectors.
- **Transition at the midrange.** Nowhere is IBM's dominance more obvious this year than at the midrange, where its proprietary AS/400 mini did so well that it propped up the entire category, which grew at 12%. Remove IBM from the equation, however, and the effects of the shift toward open systems becomes clearer. Many vendors making the transition from proprietary to UNIX-based systems have taken it on the chin. Wang's mini revenues fell 24%, Prime's and Data General's fell more than 16%. HP's mini revenues dropped 2.4%, and Unisys's fell 1.9%. Digital and Tandem Computers Inc. turned in modest increases in the 6–9% range. Both Digital and Tandem have strategies to shift to open systems; HP must successfully build on its 1989 acquisition of Apollo Computer Inc. Mergers are likely, and missteps are not allowed. Companies like Mips Computer Systems Inc., Pyramid Technology Corp., Sequent Computer Systems Inc. and Sun, which have successfully built product lines using open architectures, are ready to step in and pick up the pieces at the merest hint of desperation.
- **The changing desktop.** The desktop PC, the most powerful IS innovation of the 1980s, will face stiff competition in the next few years from laptop and notebook-sized computers. Although they are relatively expensive now, the price point will decline, making these machines even more attractive compared with traditional desktop systems. Desktop systems, too, have ridden the pricing curve downward. Apple, for example, introduced the $1,000 Mac Classic, marking a major shift in strategy for Apple, which has long enjoyed some of the fattest margins in all of IS. Margins on these machines are as small as their LCD screens. By cutting its prices in half, Apple has fired its biggest gun in the PC price war and found itself almost immediately trampling on IBM's market share. In sales during the first quarter of 1991, Apple's share exceeded IBM's for the first time. Meanwhile, in the IBM-compatible market, AST Research and Dell are putting the squeeze on both IBM and Compaq Computer Corp.

Falling Fortunes

The companies that couldn't keep up.

	COMPANY	1990 IS REVENUE	1989 IS REVENUE	% DECREASE
1	Control Data*	1,121.9	2,900.0	-61.31%
2	Kodak*	320.0	445.0	-28.09%
3	Lockheed*	494.0	590.0	-16.27%
4	Concurrent	296.0	345.0	-14.20%
5	Bolt Beranek & Newman	204.3	236.2	-13.49%
6	Ashton-Tate	230.5	265.3	-13.12%
7	Atari	325.7	374.5	-13.03%
8	National Data	244.6	275.7	-11.28%
9	Datapoint	265.6	299.0	-11.17%
10	Boeing	320.0	359.2	-10.91%

All revenue figures in millions.
* Revenue change due to disacquisition

■ **The rise of Microsoft.** The biggest event of 1990 was clearly the massive sales of Windows 3.0. Marc Schulman, who follows IS for UBS Securities Inc., likens the popularity of Windows 3.0 to the impact of IBM's family of 360 mainframes in the 1960s. According to Schulman, Windows is pivotal in establishing Microsoft as a company that no longer rides IBM's coattails. In addition to its dominance of the PC operating system market, Microsoft is a powerful force in both the IBM and Macintosh applications world. And the Redmond, Wash., giant is readying its assault on the workstation world. In 1990, Microsoft surpassed Computer Associates International Inc. to become the largest company on the DATAMATION 100 devoted entirely to software.

Software And Services Are Hot

Microsoft, of course, was not the only software company to prosper last year. In general, the new choices created by open systems and the pressures on user companies to gain greater efficiency in down times was good news for both software and services companies. Software and services, including hardware maintenance, accounted for 23% of DATAMATION North American 100 sales in 1990. There are now 39 companies on the North American list that specialize primarily in software and services.

Some PC software companies, which alone accounted for more than $3 billion in sales in 1990, are growing 25 to 30% a year, a rate that is unlikely to be hampered by the recession. "PC software packages offer astonishing paybacks of 10 to 20 times cost within one year," says Michael Kwatinetz, an analyst for Sanford C. Bernstein & Co. Inc., a New York City-based investment research firm. Kwatinetz predicts that presentation graphics software, such as Harvard Graphics, will grow the fastest of any applications software.

Services firms such as Coopers & Lybrand, which drew its 57.9% increase in revenues from consulting and systems integration, are ideally positioned to capitalize on the downsizing that was amply evident in 1990. With computer-aided software engineering tools, outsourcing and back-office processing services, these firms are able to give clients what they need to save money and resources. "In tough economic times, people have some strong motivations to come to us," observes Gary S. Fernandes, senior vice president of Electronic Data Systems Corp., which saw revenue not related to its parent General Motors Corp. rise 16% in 1990. And by providing systems integration and custom programming, service firms can help clients build the kind of strategic systems they will need to prosper when the economy picks up again.

In The Red

The companies that lost money.

	COMPANY	1990 EARNINGS LOSS ($ MIL.)
1	Wang	(665.4)
2	Unisys	(437.0)
3	Data General	(119.3)
4	Digital	(94.5)
5	Western Digital	(78.6)
6	Tektronix	(70.1)
7	MAI Systems	(64.5)
8	Concurrent	(60.0)
9	Texas Instruments	(39.0)
10	SHL	(35.0)

Big Exporters In North America

The North American companies with the most IS sales outside their home market.

COMPANY	NORTH AMERICA	EUROPE	ASIA PACIFIC	OTHER
IBM	26,165.1	26,836.0	9,392.6	4,696.3
Digital	5,621.1	5,490.4	1,830.1	130.7
Hewlett-Packard	4,185.0	3,534.0	1,581.0	0.0
NCR	2,134.5	1,966.0	1,179.6	337.0
Apple	3,329.2	1,607.2	746.2	57.4
Compaq	1,655.1	1,691.1	215.9	36.0
Xerox	1,400.0	980.0	140.0	280.0
Sun	1,381.4	828.9	552.6	0.0
Wang	1,157.9	756.2	449.0	0.0
Tandem	880.4	618.1	374.6	0.0

All revenue figures in millions.

On Wall Street, for example, which had one of the worst years in its history in 1990, Salomon Brothers Inc., the big bond-trading house, remained committed to an ambitious five-year, $100 million plan for a trading room/back office network built on UNIX—a technology that has found minimal acceptance to date in the financial sector. At the same time, Salomon also inked a deal with Andersen Consulting to take over the job of maintaining its IBM systems.

For services firms, the main competition for market share will come from hardware manufacturers, as they try to recapture the business they've been losing to the likes of EDS and Andersen Consulting. And services firms are also feeling the hardware pinch. "Our margins on hardware are down," said Peter Sandiford of SHL Systemhouse Inc. "Our customers are looking at the hardware component and asking how they can do it cheaper themselves."

It's an axiom in business that decisions made when times are bad are the ones that dictate how good the good times will really be. Tough times for the vendor community can translate into more influence for the users. The pressures generated by the recession and by the user community's demand for truly cost-effective systems may, in the end, create a stronger and more responsive industry. ▭

Joseph Kelly is a contributing editor based in New York City.

Scorecards On The Best

IBM is tops in large-scale systems, midrange machines, PCs, peripherals, data communications, software and maintenance. It's third in workstations and sixth in services. Market share figures are based on the DATAMATION North American 100 market.

Large-Scale Systems

		REVENUE ($ MIL.)		%	MARKET
	COMPANY	1990	1989	CHANGE	SHARE**
1	IBM	10632.0	12100.0*	-12.13%	73.58%
2	Amdahl	1360.0	1470.8	-7.53%	9.41%
3	Unisys	1016.0	1200.0	-15.33%	7.03%
4	Cray	590.2	633.6	-6.85%	4.08%
5	Control Data	265.0	465.0	-43.01%	1.83%
6	Convex	209.3	N/A	N/A	1.45%
7	Digital	185.0	N/A	N/A	1.28%
8	NCR	164.0	183.4	-10.58%	1.13%
9	Sequent	28.4	N/A	N/A	0.20%

*Restated figure
** Percentage share of DTM 100 revenues.

Midrange

		REVENUE ($ MIL.)		%	MARKET
	COMPANY	1990	1989	CHANGE	SHARE**
1	IBM	5,801.0	4,136.0*	40.26%	41.40%
2	Digital	2,830.0	2,670.0	5.99%	20.20%
3	Unisys	1,100.0	1,122.0	-1.96%	7.85%
4	Tandem	770.0	709.6	8.51%	5.50%
5	Hewlett-Packard	732.0	750.0	-2.40%	5.22%
6	Prime	556.2	665.0*	-16.40%	3.97%
7	Wang	430.0	570.0	-24.56%	3.07%
8	NCR	428.0	475.0	-9.89%	3.05%
9	Stratus	403.9	310.1	30.25%	2.88%
10	Data General	204.3	245.9	-16.92%	1.46%

*Restated figure
** Percentage share of DTM 100 revenues.

Personal Computers

		REVENUE ($ MIL.)		%	MARKET
	COMPANY	1990	1989	CHANGE	SHARE**
1	IBM	9,644.0	8,343.0	15.59%	37.66%
2	Apple	3,845.8	3,574.2	7.60%	15.02%
3	Compaq	3,598.0	2,876.1	25.10%	14.05%
4	Unisys	1,181.0	1,300.0	-9.15%	4.61%
5	Commodore	995.7	866.5	14.91%	3.89%
6	Intel	980.0	812.0	20.69%	3.83%
7	Tandy	850.3	689.1*	23.39%	3.32%
8	AT&T	700.0	700.0	0.00%	2.73%
9	Hewlett-Packard	625.0	850.0	-26.47%	2.44%
10	Dell	546.0	307.0	77.85%	2.13%

*Restated figure
** Percentage share of DTM 100 revenues.

Workstations

		REVENUE ($ MIL.)		%	MARKET
	COMPANY	1990	1989	CHANGE	SHARE**
1	Sun	1,934.0	1,443.8	33.95%	27.11%
2	Digital	1,250.0	1,195.0	4.60%	17.52%
3	IBM	1,000.0	591.0	69.20%	14.02%
4	Hewlett-Packard	920.0	825.0	11.52%	12.89%
5	Silicon Graphics	414.6	291.6	42.18%	5.81%
6	Intergraph	344.7	260.0	32.58%	4.83%
7	Xerox	310.0	325.0	-4.62%	4.34%
8	Mentor	170.1	167.0*	1.89%	2.38%
9	Control Data	140.7	N/A	N/A	1.97%
10	Unisys	126.0	N/A	N/A	1.77%

*Restated figure
** Percentage share of DTM 100 revenues.

Software

		REVENUE ($ MIL.)		%	MARKET
	COMPANY	1990	1989	CHANGE	SHARE**
1	IBM	9,952.0	8,424.0	18.14%	50.21%
2	Microsoft	1,323.0	820.8	61.18%	6.67%
3	Computer Associates	1,310.7	1,290.2	1.59%	6.61%
4	Digital	810.0	825.0	-1.82%	4.09%
5	Oracle	702.5	554.3	26.74%	3.54%
6	Lotus	634.5	516.0	22.97%	3.20%
7	Unisys	600.0	875.0	-31.43%	3.03%
8	D&B Software	539.0	450.0	19.78%	2.72%
9	WordPerfect	452.4	281.0	61.00%	2.28%
10	Novell	388.1	287.6	34.94%	1.96%

** Percentage share of DTM 100 revenues.

Peripherals

	COMPANY	REVENUE ($ MIL.) 1990	REVENUE ($ MIL.) 1989	% CHANGE	MARKET SHARE**
1	IBM	12,405.0	10,049.0	23.45%	33.42%
2	Hewlett-Packard	3,820.0	2,275.0	67.91%	10.29%
3	Digital	3,000.0	3,200.0	-6.25%	8.08%
4	Seagate	2,667.6	1,797.0	48.45%	7.19%
5	NCR	2,090.0	1,989.6	5.05%	5.63%
6	Apple	1,722.0	1,635.6	5.28%	4.64%
7	Conner Peripherals	1,337.5	704.9	89.74%	3.60%
8	Xerox	1,100.0	1,025.0	7.32%	2.96%
9	Unisys	1,100.0	1,039.0	5.87%	2.96%
10	StorageTek	815.0	710.5	14.71%	2.20%

** Percentage share of DTM 100 revenues.

Data Communications

	COMPANY	REVENUE ($ MIL.) 1990	REVENUE ($ MIL.) 1989	% CHANGE	MARKET SHARE**
1	IBM	2,950.0	3,000.0	-1.67%	34.49%
2	AT&T	1,465.0	1,445.0	1.38%	17.13%
3	Northern Telecom	1,220.0	1,150.0	6.09%	14.26%
4	Motorola	599.0	500.0	19.80%	7.00%
5	Unisys	425.0	375.0	13.33%	4.97%
6	Hewlett-Packard	400.0	500.0	-20.00%	4.68%
7	Xerox	380.0	400.0	-5.00%	4.44%
8	3Com	324.0	306.4*	5.74%	3.79%
9	Digital	275.0	225.0	22.22%	3.22%
10	Digital Communications	186.9	213.5	-12.46%	2.19%

* Restated figure
** Percentage share of DTM 100 revenues.

Services

	COMPANY	REVENUE ($ MIL.) 1990	REVENUE ($ MIL.) 1989	% CHANGE	MARKET SHARE*
1	EDS	2,870.0	2,477.9	15.82%	14.91%
2	TRW	1,739.0	1,565.0	11.12%	9.03%
3	ADP	1,730.0	1,689.5	2.40%	8.99%
4	CSC	1,679.3	1,442.8	16.39%	8.72%
5	Andersen Consulting	1,536.6	1,225.7	25.53%	7.99%
6	IBM	1,500.0	1,200.0	25.00%	7.79%
7	Digital	1,162.3	1,386.7	-16.18%	6.04%
8	Unisys	900.0	825.0	9.09%	4.67%
9	American Express	827.0	660.0	25.30%	4.30%
10	Black & Decker	692.1	687.6	0.65%	3.60%

** Percentage share of DTM 100 revenues.

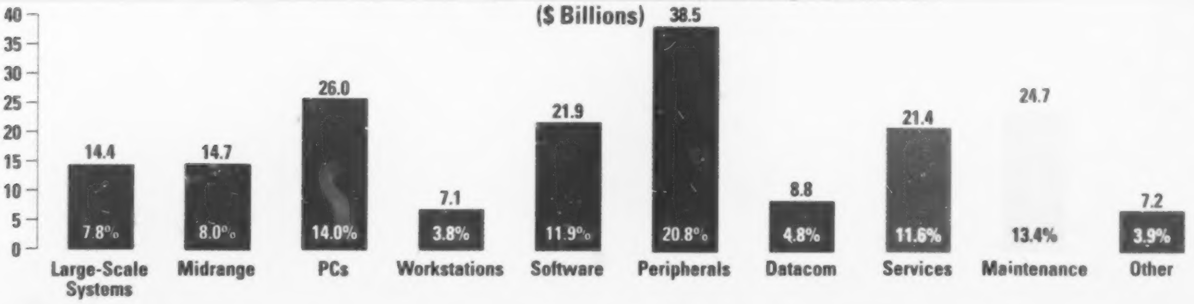
Maintenance

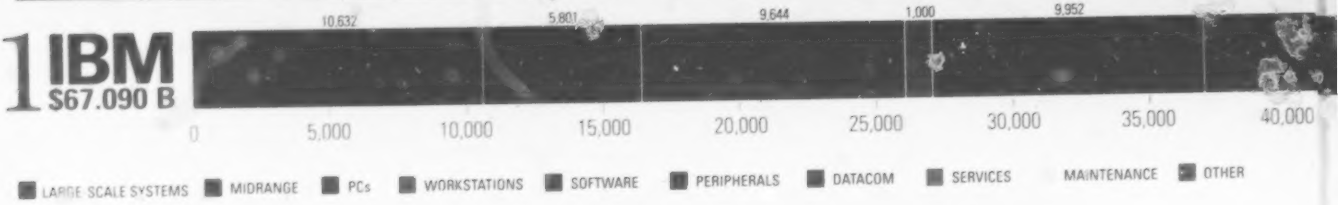
	COMPANY	REVENUE ($ MIL.) 1990	REVENUE ($ MIL.) 1989	% CHANGE	MARKET SHARE**
1	IBM	7,768.0	7,036.0	10.40%	33.21%
2	Digital	3,450.0	3,300.0	4.55%	14.75%
3	Hewlett-Packard	2,503.0	2,000.0	25.15%	10.70%
4	Unisys	1,990.0	1,947.0	2.21%	8.51%
5	NCR	1,770.0	1,647.0	7.47%	7.57%
6	Wang	994.0	994.0	0.00%	4.25%
7	Xerox	820.0	850.0	-3.53%	3.51%
8	Prime	635.6	563.0*	12.90%	2.72%
9	Data General	433.1	430.6	0.58%	1.85%
10	Amdahl	345.4	273.1	26.47%	1.48%

*Restated figure
** Percentage share of DTM 100 revenues.

Total Revenues By Category Of The DATAMATION North American 100

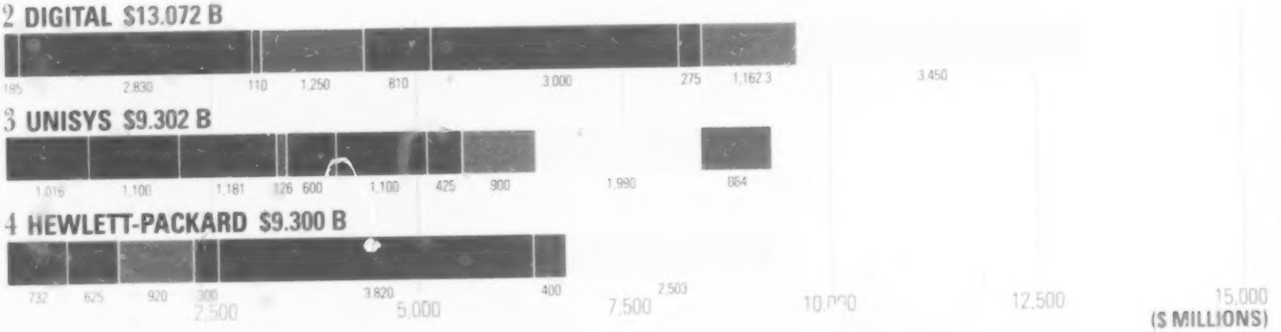
The following is a breakdown of the $184.7 billion North American revenues. Included is the dollar figure, as well as the percentage of the total.

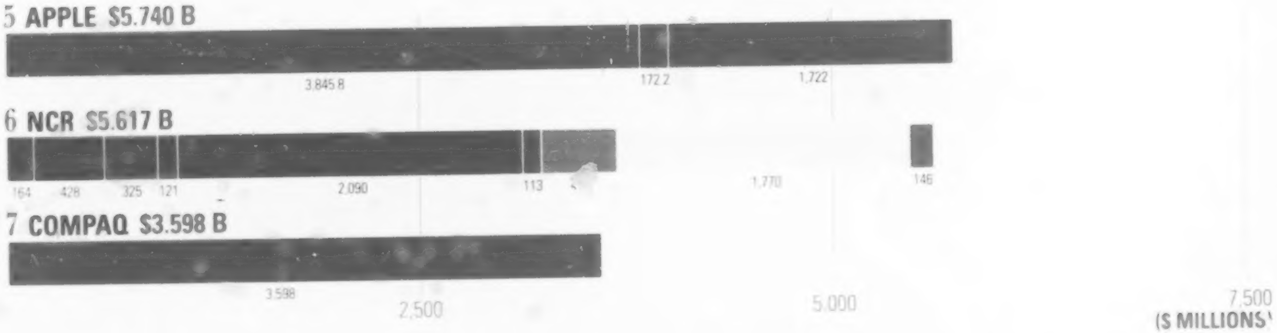


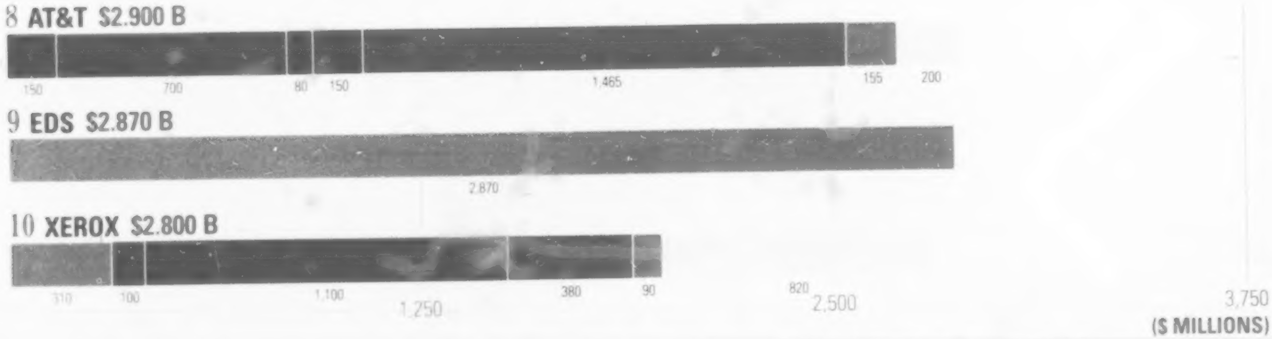


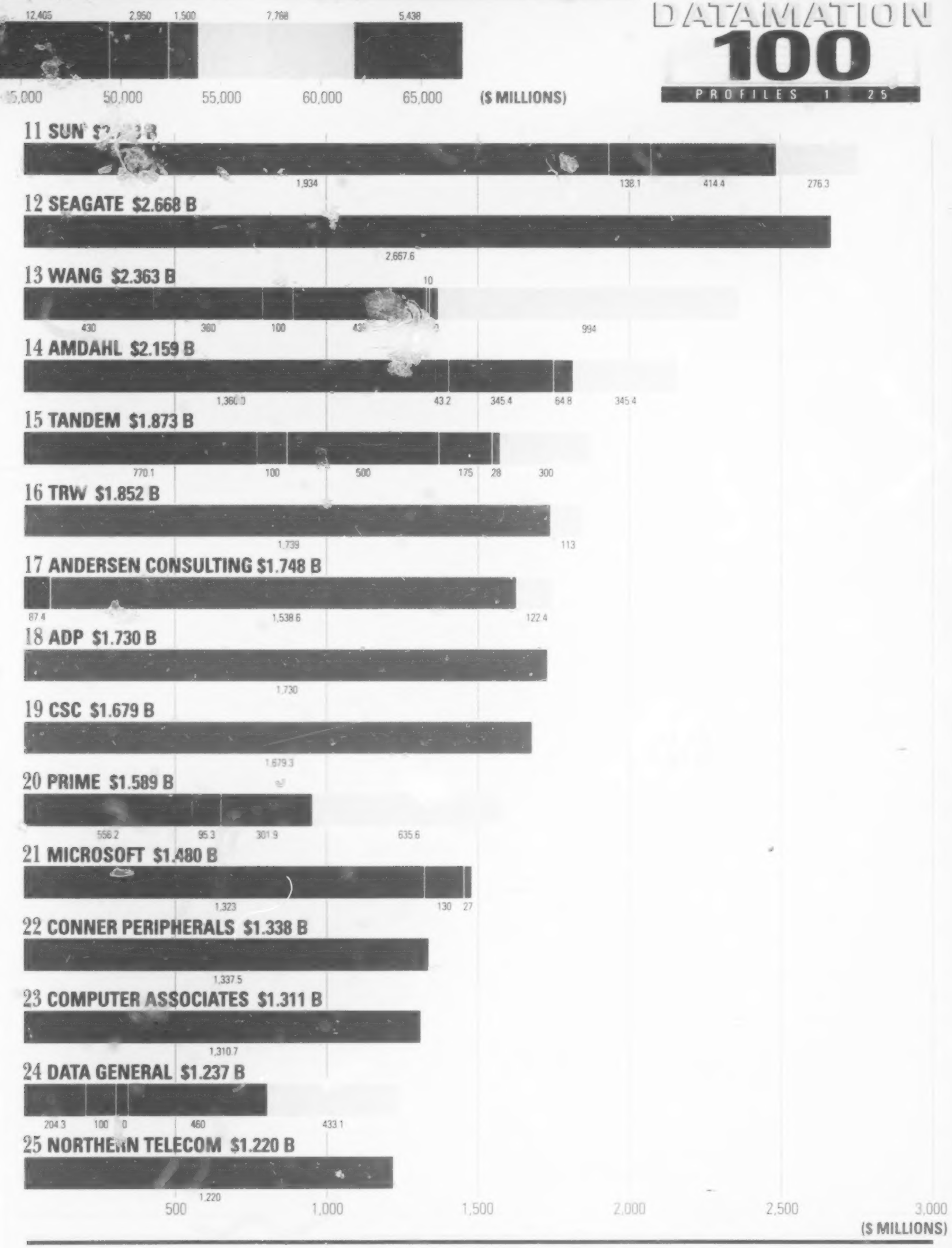
TOP 25

Conner Peripherals rockets 13 places, Wang and TRW drop three spots. EDS breaks into the top 10, the top eight stand firm.








12,405
2,950
1,500
7,768
5,438
5,000
50,000
55,000
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65,000
($ MILLIONS)
11 SUN $2.[illegible] B
1,934
138.1
414.4
276.3
12 SEAGATE $2.668 B
2,667.6
13 WANG $2.363 B
10
430
360
100
43[illegible]
994
14 AMDAHL $2.159 B
1,360.0
43.2
345.4
64.8
345.4
15 TANDEM $1.873 B
770.1
100
500
175
28
300
16 TRW $1.852 B
1,739
113
17 ANDERSEN CONSULTING $1.748 B
87.4
1,538.6
122.4
18 ADP $1.730 B
1,730
19 CSC $1.679 B
1,679.3
20 PRIME $1.589 B
556.2
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301.9
635.6
21 MICROSOFT $1.480 B
1,323
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22 CONNER PERIPHERALS $1.338 B
1,337.5
23 COMPUTER ASSOCIATES $1.311 B
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24 DATA GENERAL $1.237 B
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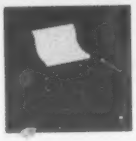
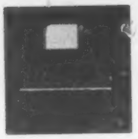
($ MILLIONS)

THE DATAMATION 100





INTERNATIONAL BUSINESS MACHINES CORP.

OLD ORCHARD ROAD
ARMONK, NY 10504
(914)-765-1900

RANK
1
IS REVENUE
$67.09 B

Several years of cost cutting and new product development investments paid off for IBM in 1990. Even as many of its large competitors suffered from slowing growth and slimmer profits, the world's largest computer company saw revenues rise an impressive 10.3% to $69.02 billion. Revenue growth was almost twice what it was for IBM in 1989. Profits were up 60.2% to $6.02 billion. IBM's 1989 earnings were reduced by a $2.4 billion restructuring charge.

A revitalized software business helped propel IBM's better than expected 1990 financial results. Improved maintenance revenues also helped, as did an estimated 17% increase in revenue from systems integration and related support services. For the last few years, as part of its customer-driven marketing focus, IBM has been attempting to boost its services and software revenues. Software revenue, at about $10 billion in 1990, was up 18.1%.

"We said early in 1990 that we would have significantly improved financial results. We feel we delivered on that," says IBM treasurer Robert Ripp.

IBM accounted for 36% of the North American 100 revenue in both 1990 and 1989.

Thanks also to strength in its midrange and workstation businesses, IBM was able in 1990 to overcome a product transition-inspired lull in the large-processor portion of its business. IBM in September made what it called its most comprehensive product announcement in 25 years, the ES/9000, which extends the 370 mainframe into a future loosely coupled, distributed-processing architecture.

The largest versions of the ES/9000 won't be available until next quarter, however. As a result, some large customers put mainframe buying plans on hold. Revenue from IBM's largest water-cooled mainframes dropped by about 15%, according to estimates by Joseph Payne of Baltimore-based Alex. Brown & Sons Inc. Strong demand for air-cooled processors and flexible lease-financing options offered by IBM, however, helped smooth over the transition. Overall, the processor business grew just 1% to $16.4 billion. IBM officials predict better mainframe revenue growth in 1991, as the new ES/9000 hardware becomes available.

Meanwhile, IBM emerged as a rejuvenated vendor of midrange systems, improving what, through much of the 1980s, was a major weakness. Revenues from air-cooled processors—including air-cooled midrange ES/9000, AS/400 machines and the RS/6000 workstation, increased by 62.9% to about $5.7 billion, according to Alex. Brown estimates. The RS/6000 was surprisingly strong. IBM said it shipped 25,000 of the new RISC workstations, worth about $1 billion in revenue in 1990.

IBM's PS/2 revenue also continued to grow, at about a 10.6% clip for the year. In short, say observers, IBM emerged in 1990 with its most balanced product line in many years. "For the first time in 20 years, I've had a hard time coming up with a major weakness in IBM's major product lines," says analyst Bob Djurdjevic of Annex Research in Phoenix.

IBM's business in 1990 continued a gradual shift in focus to markets outside the United States. In fact, IBM's sales in Europe, which grew to about 39.5% of total revenues, caught up with IBM's sales in the States for the first time. Currency fluctuations accelerated the trend. But IBM officials also point to stronger fundamental economies in Europe and Asia.

In order to take advantage of faster non-U.S. growth, IBM made some organizational changes in 1990. For one thing, the company moved management of its Communications Systems line of business from Somers, N.Y., to Europe. And, while continuing to cut head count in the United States by about 10,000 in 1990, IBM held the number of employees in Europe steady.

But not for long.

Despite its strong showing in 1990, the ongoing recession and resulting restrained IS budgets at most user organizations cast a pall over IBM going into 1991. In March, IBM announced layoffs of 14,000 employees worldwide and shocked analysts by announcing that first-quarter 1991 earnings would be half what they were in the same quarter of 1990. Observers said that means it will be difficult for IBM to report any profit gain in 1991.

IBM officials maintain that its software and services businesses remain healthy despite the first-quarter downturn. They attribute the earnings slump to an across the board slump in IS spending and not to soft demand for any particular product line, including the ES/9000.

In fact, IBM officials say that through the rest of 1991 they will focus on a successful rollout of the new ES/9000 mainframes while continuing to cut costs. According to Treasurer Ripp: "Our projections are that we will finish 1991 at a lower head count. The question is going to be what happens with the economy in 1991."

IBM has planned for a slow first half of 1991 followed by recovery in the second half. Still, world economies are expected to grow slower as a whole this year than they did in 1990; some predict growth in gross national product of less than 1% in the United States and between 1 and 2% in Europe and Japan. According to Ripp that means "it's going to be hard to repeat a 10% revenue growth in 1991."

If the first quarter is any indication, that may prove to be an understatement.

—Jeff Moad

DIGITAL EQUIPMENT CORP.

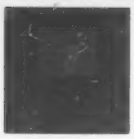
146 MAIN STREET
MAYNARD, MA 01754
(508)-897-5111

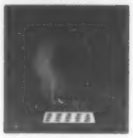
RANK
2
IS REVENUE
$13.07 B

Digital Equipment Corp. was shaken by a year of major change in 1990. Revenues were flat, managing just a 1% increase from $12.93 billion at the end of 1989 to $13.07 billion in 1990, and all of that growth came from outside the United States.

Earnings took a fearful dive. In June, Digital posted its first-ever quarterly loss, of $256.7 million, after a $400 million restructuring charge. That loss shocked the financial community, as well as the computer industry. At the end of the year, after taxes and restructuring charges that totaled $550 million, Digital lost $94.5 million. Most of the restructuring charge stemmed from severance packages received by 2,550 employees who left via a voluntary departure program last year. Through the first involuntary departure program in its history, Digital will reduce its work force by another 2,500 to 3,500 people by June 30, the end of its 1991 fiscal year.

But compared with others of its ilk, Digital still looks pretty good; it has a low debt load and more than $1 billion in the bank. It's well positioned to change its product line as well as its marketing efforts, and it is doing so





with almost furious activity.

Digital is trying to become a company that specializes in integrated solutions, says senior vice president Winston R. Hindle Jr. Toward that end, Digital created numerous Integration Business Units last year, primarily focusing on vertical markets.

The company is making a push into software—most notably by creating the Software Products Group, which oversees the company's software research, development and licensing. Among the group's most important projects are attempts to revamp software licensing, the integration of Digital's Portable Operating System Interface for UNIX (POSIX) into the VMS kernel and further development of its Network Application Support (NAS) services. Digital may soon license NAS services to other vendors.

Despite the emphasis on software, however, the VAX architecture remains critical to Digital's strategy. The company shipped the first of its mainframe line, the VAX 9000, late in 1990, after a delay of some six to nine months. Technical problems plagued the line early on, causing the company to recall all of its processors and fix bugs. Now, however, Digital claims customers are happy with the product and says it had sold about 200 units by early this year.

Much of the $1.6 billion that Digital spent on research and development in 1990 went toward its Alpha project, a line of VAX systems based on internally developed reduced instruction set computing (RISC) technology. Although Digital's goal is to announce products in the first quarter of calendar 1992, analysts feel they won't be available until at least the end of 1992 due to problems getting the VMS operating system and VMS applications to run on them.

In calendar 1990, 57% of Digital's sales came from outside the United States. Strong areas included Japan, where the company hopes to realize almost $1 billion in revenue during calendar 1991. Eastern Europe is also attracting the company's attention. Digital made investments in Hungary last year and is opening a subsidiary in Prague, Czechoslovakia. Most significantly, Digital and Mannesmann AG formed Digital-Kienzle Computer Systeme GmbH & Co. KG, a joint venture that will sell systems to small and midsized businesses through value-added resellers. Digital owns 65% ($230 million) of the Villingen, Germany-based company.

The biggest challenge for Digital remains its ability to increase revenues and decrease costs in an uncertain economy. Says Digital's Hindle: "Clearly, the U.S. economy is the biggest question mark we have in front of us. And we have no idea when it's going to change."—*Elaine L. Appleton*

UNISYS CORP.

TOWNSHIPLINE AND UNION
MEETING ROADS
BLUE BELL, PA 19424
(215)-986-4011

RANK 3
IS REVENUE $9.30 B

Can this company survive?

As unthinkable as this question might be for the third largest U.S. computer company, one with corporate revenues greater than $10 billion, it is one increasingly being asked in financial circles, as Unisys Corp., still burdened by a massive debt, struggles to regain profitability after losing more than $1 billion over a two-year period.

After spilling $639 million in red ink in 1989, Unisys stayed in the red in 1990—losing $437 million on flat revenues of $10 billion. Cognizant of its financial obligations, which include a $300 million installment (due this fall) on its $4 billion debt, Unisys entered 1991 in search of buyers for its nonstrategic assets.

"1990 was the year the chickens came home to roost on the merger in 1986," says George Lindamood, director of high-performance computing at the Gartner Group Inc. The Stamford, Conn.-based analyst is referring, of course, to the debt and the technological burdens Unisys assumed from the merger of the two companies that formed it—Burroughs Corp. and Sperry Corp. "The issue going into 1991 is: Can they turn their financial picture around? It's something they have to accomplish by the end of this year," says Lindamood.

"We know what we have to do," answers Everett M. Ehrlich, vice president for financial planning at Unisys. "Our goal is to reduce our debt by between $600 million and $800 million in 1991."

Unisys knocked about $200 million off its debt in 1990, taking such drastic action as eliminating its dividends to shareholders to free up cash for repaying loans. Unisys might have been able to reduce its debt further had the slump in the worldwide economy not sapped demand for its systems in the second half of 1990.

Not all the Unisys news in 1990 was bad, however. The company generated $44 million in operating profits for the year (what dragged down earnings was the nearly $450 million in debt-related interest expenses). With its InfoImage line of products, the company emerged as a leading supplier of image-processing systems, winning orders from the likes of Signet Bank NA and The Chase Manhattan Bank. And it unveiled the Unisys Architecture—a technology blueprint for Unisys's customers to follow in the 1990s.

These efforts are leading many large customers to stick with Unisys. "Most people are more concerned with what is being delivered and what's in the pipeline" than with the company's financial woes, says Tim Hind, president of the CUBE Inc. Unisys user group.

In 1991, Unisys is continuing to try to raise cash, cut expenses and focus on key products and markets. The company expects to raise between $1 billion and $2 billion in cash through the sale of assets, although it won't identify which assets are on the block. Securities analysts speculate that the company's Timeplex data communications unit and its interest in Nihon Unisys, one of Japan's largest computer companies, may be up for sale. It plans to have eliminated another 5,000 of its 75,000 jobs during the first half of the year. And it intends to focus on UNIX-based client/server technologies; image applications; and key customer segments like the telecommunications, airlines and financial services industries.—*Jeff Moad*

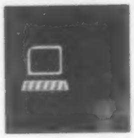
HEWLETT-PACKARD CO.

3000 HANOVER STREET
PALO ALTO, CA 94304
(415)-857-1501

RANK 4
IS REVENUE $9.30 B

"Nineteen-ninety was supposed to be the year of the 68040," says Willem P. Roelandts, vice president of Hewlett-Packard Co.'s Networked Systems Division, referring to the Motorola Inc. microprocessor around which HP had built so many of its product plans for the year. Instead, 1990 revolved around a number of successes in product areas other than workstations, where delays in 68040 shipments cost the company market share and momentum.

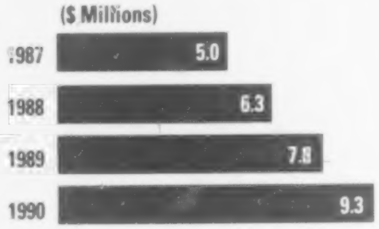
HP's worldwide revenues from all its businesses—computers, test and measurement (T&M) equipment, medical products, etc.—expanded 10% to $13.2 billion in 1990 for the 12-month period that ended on October 31 of last year. Geographically, much of the growth came from overseas. HP generated nearly 55% of its business in Asia and Europe. In fact, Europe is so important to HP that it chose last year to relocate its worldwide PC operations there. The company kept its technological lead in the printer field by virtue of products like the LaserJet III and IIP desktop laser printers. Additionally, the company got a big boost from servicing all of the midrange systems it installed during the 1980s and into 1990.



Still, HP's performance could have been better. Its systems business—where the company lumps T&M products in with its 9000 and 3000 series of midrange and workstation systems—only expanded 5% to $4.9 billion in 1990. Dean Morton, the company's chief operating officer, insists that if HP had chosen to break out sales of midrange systems separately, observers would have seen 60% growth in its UNIX-based products and respectable expansion of its proprietary MPE-based line. If Motorola had been able to deliver quantities of its 32-bit 68040 chip on time, HP executives contend, the systems group would have sold a lot more workstations—enough, perhaps, to eclipse Sun Microsystems Inc. as the workstation market leader and to cover the company's rising costs.

Those costs wreaked havoc with HP's bottom line, which plunged 11% in 1990 to $739 million. The costs reflect the shift in HP's product mix toward more products sold through indirect channels. HP was forced to give substantial discounts to the dealers, resellers and original equipment manufacturers (OEMs), who together generate 60% of HP's computer sales. That raised its cost of goods sold to nearly 53% of corporate revenues.

HP's IS revenue has grown 86% since 1987.



The distribution channel issue factored heavily in the reorganization of HP's computer businesses, that occurred in October. The change left Lewis E. Platt in charge of HP's Computer Systems Organization, overseeing Roelandts and other executives charged with developing and selling midrange systems and workstations—products best suited for direct sales channels. Platt's counterpart, Richard A. Hackborn, heads up HP's Computer Products Organization, championing the company's leading-edge PCs and phenomenally successful peripherals—goods that move through resellers.

HP struck several alliances with major suppliers in 1990. The firm bought 10% of Informix Software Inc., its second relational database software partner. HP will team up with Sun to jointly develop object-oriented software technology. Hitachi Ltd. has decided to collaborate on developing expert systems applications. Computer Associates International Inc. will develop UNIX-based applications for HP's systems.—*Tim Mead*

APPLE COMPUTER INC.

20525 MARIANI AVENUE
CUPERTINO, CA 95014
(408)-996-1010

RANK
5
IS REVENUE
$5.74 B

Apparently, it's not impossible to turn on a dime if you're a $5.7 billion company. Just look at what Apple Computer Inc. did in 1990. It began the year with mostly a high-end product set marketed by a former IS chief aimed squarely at information systems shops in big organizations. It ended 1990 with a suite of low-end products targeted straight for mass markets and honchoed by a professional marketer who cut his teeth in Europe.

Apple's new direction is paying off on the top revenue line but raising questions about its impact on the bottom profit line. Revenues for the company expanded 12% in the fourth quarter of 1990, following the introduction of three low-cost Macintosh systems in October. For the year, Apple's sales expanded almost 7% from $5.37 billion to $5.74 billion. In the first quarter of 1991, when the new Macs shipped in greater volume, earnings were flat at $131 million, despite an 18% jump in sales over the same period of 1990.

"We know the high-volume, low-cost pricing strategy will affect bottom-line performance," says Joseph Graziano, Apple's executive vice president and chief financial officer. "There's no question we're changing our economic business model."

The new model is designed to gain market share, pure and simple. The master of the model remains John Sculley, chairman and chief executive officer of Apple. But he's got a powerful new ally in Michael E. Spindler, who had headed up Apple's European operations prior to being elevated to president and chief operating officer for all of Apple. Gone from Apple's core management team is Allan Loren, who arrived at Apple in 1987 as its IS chief and worked his way up to become president of Apple USA in 1988. Gone, too, is the individual who oversaw development of many of the products Loren took to the corporate IS market—Jean Louis Gassée, who resigned as head of Apple Products.

The chief product components of the model are the three new low-end machines—Mac Classic, Mac LC and Mac IIsi, ranging in price from $1,060 to $2,625—and the high-end systems developed on the Loren/Gassée watch—Mac IIci and Mac IIfx, priced between $5,300 and $7,400.

The economics of the new model require Apple to reduce sales and marketing expenses, Graziano says. Research and development will be spared Apple's Slim-Fast program, with R&D outlays earmarked at 9% of revenues in 1991.

One outcome of Apple's research efforts should be visible soon—a new operating system (7.0) for its Macintosh machines. Nobody is certain, however, whether it will arrive in time to thwart any defections in the corporate IS community to Macintosh's chief rival, the IBM-compatible personal computers shipping with Microsoft Inc.'s highly successful Windows 3.0 graphical user interface software.

Other byproducts of Apple's R&D efforts that should surface in 1991 are a high-end machine based on Motorola Inc.'s 68040 32-bit microprocessor and a notebook PC being developed with Sony Corp. "The business market is very important to the company, and Apple still needs to be successful there," Graziano says, referring to the company's 68040 product plans. "We've been weak in the portable and laptop markets, and we're looking to improve that," he says of Apple's notebook initiative.—*John McMullen*

NCR CORP.

1700 SOUTH PATTERSON BOULEVARD
DAYTON, OH 45479
(513)-445-5000

RANK
6
IS REVENUE
$5.62 B

It was a case of good news and bad news in 1990 for NCR Corp.

On the positive side of the ledger, NCR successfully pulled off a large and complicated new product strategy and product statement—its Open Cooperative Computing Architecture (OCCA). And while attempting to make the difficult transition from proprietary mainframe systems to open, standards-based products, NCR managed to sustain revenue growth, even in the face of the recession. The company reported an almost 6% jump in revenue for the year to $6.18 billion. Net income, at $369 million, was down 10%, largely because of lower profit margins resulting from development and marketing of the new products.

On the negative side—at least from the point of view of NCR's management—OCCA's success helped attract a $5.9 billion hostile takeover bid from AT&T. While some NCR officials insisted that the AT&T bid did nothing to reduce customer orders or confidence, NCR chairman and chief executive officer Charles E. Exley Jr. personally took on the challenge of fighting off the AT&T bid as if it were a bad case of the flu. And many analysts concurred that a takeover of NCR by AT&T, which has been profoundly unsuccessful in the computer business, would be the kiss of death.

"Anybody who's any good will leave NCR," says analyst Peter Labe of Labe, Simpson & Co. Inc., based in New York City. "AT&T will destroy it." Likewise, some NCR customers were unenthusiastic. "History has shown that this kind of merger doesn't work," says Roger D. Wohler, data-processing manager for the Kansas State University Foundation in Manhattan, Kan. In May, AT&T upped its offer to $7.84 billion which Exley found he couldn't refuse. At press time NCR had agreed to the AT&T takeover.

Despite the takeover threat, NCR reported strong customer interest through 1990, in its OCCA products, the most impressive being a broad family of Intel- and UNIX-based multiprocessors and loosely coupled systems called System 3000. Other OCCA products include Open Systems Interconnect-based networking software and object-oriented software based on a graphical user interface.

The Kansas State University Foundation was among the first to order a 3450 multiprocessor system, which will replace an NCR 9300 mainframe. NCR also received early orders for System 3000 products from retailers K mart Corp. and Wal-Mart Stores Inc. and from communications companies Bell Canada and BellSouth Corp. Among the beta sites for OCCA software were Chemical Bank and Citicorp.

NCR officials say they expect moderate growth in both sales and earnings in 1991, despite continuing margin pressures and the ongoing recession at least through the first half of the year. As in 1990, most of the company's revenue growth will come from outside the United States, according to senior vice president for finance and administration John L. Giering. In 1990, international revenue for NCR increased 11%, whereas U.S. revenue fell 2%.

Continued pressure on margins will come from higher marketing and research and development expenses, as NCR continues to develop and sell the OCCA products. R&D spending grew from NCR's historic 6+% levels to about 8% of sales in 1990. Marketing expenses rose 6.5% for the year. Giering, however, predicts that profit margins will improve late in the year as NCR begins to ship its large loosely coupled 3600 systems and more OCCA software.

Analyst Labe says 1991 will be another low-growth transition year for NCR. "But in 1992 and 1993, you ought to see this tree blossom, if it is allowed to," he says.—*Jeff Moad*

COMPAQ COMPUTER CORP.

20555 STATE HIGHWAY 249
HOUSTON, TX 77070
(713)-370-0670

RANK
7
IS REVENUE
$3.60 B

For a company that traces its origins back to a discussion in a late night Texas coffee shop, Compaq Computer Corp. has been anything but provincial in its outlook—or in its revenues. Compaq's sales now spout primarily (54%) from the international side, with the other 46% coming from the United States.

That strong overseas showing has served the company well. Considering that much of the PC industry was stagnant last year, Compaq—which reported sales increases of 25%—looked strong. And much of that strength is due to the company's firm footing overseas.

Compaq's European success was largely under the purview of Eckhard Pfeiffer, who headed up the company's European operation until January 1991. That's when he became chief operating officer, taking on many of the duties of departing Michael S. Swavely, former president of U.S. operations. In Compaq's consensus management style, it's difficult to determine the impact of individual executives, but it's likely Pfeiffer will make his mark down the road. Chief executive Rod Canion, for instance, plans to concentrate more on long-range plans for the company.

Shortly after Pfeiffer was named to his new post, the company shored up its service and support offerings by opening up a telephone support line and offering various service packages through dealers—something many analysts said was long overdue. Although these changes reportedly were planned prior to Pfeiffer's arrival, the company used its European support operation as a model. Pfeiffer says its success can be attributed to Compaq's decision to be selective in choosing European dealers. "Early on, we emphasized strong country organizations in Europe. And that paid off because we were able to sign up strong dealers," Pfeiffer says.

European users seem to relish the extra attention. According to Dan Jacobson, data-processing manager at Norway's Kommunes Centralfordunde, a municipal government agency in Oslo, Compaq's reputation for support was one factor leading to his recent migration from an IBM AS/400 midrange machine to a Compaq SystemPRO. "If it's a minor problem, we go to our dealer, but if it a major problem we can go to them [Compaq]," says Jacobson.

Although it's not been without some stumbles, the company has done fairly well with the SystemPRO, its initial server. Sales of the dual-processor machine reached $200 million in 1990, Pfeiffer says. Last year's real superstar, however, was Compaq's diminutive LTE notebook computer family. Demand overran supply throughout 1990, a situation Compaq hopes to resolve by summer.

The notebook PC field has since attracted a host of competitors, many of them offering lower cost products than Compaq. Nevertheless, analysts aren't worried; they think that Compaq's reputation for quality and innovation will keep it in the forefront. Says analyst Mark Stahlman at New York City-based Alex. Brown & Sons Inc. "Compaq is still able to leapfrog its competitors in portable products, and that's key in this market."

Not bad for a cup of coffee.—*Bob Francis*

AMERICAN TELEPHONE AND TELEGRAPH CO.

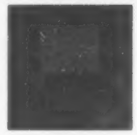
550 MADISON AVENUE
NEW YORK, NY 10022
(212)-605-5500

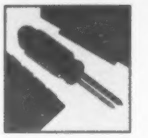
RANK
8
IS REVENUE
$2.90 B

AT&T was the talk of the industry in 1990, as the company moved to acquire NCR Corp. The hostile takeover attempt overshadowed what would have been significant developments in any other year for the communications giant's commercial information systems arm, the AT&T Computer Systems Group, headquartered in Morristown, N.J.

Here are just some of the highlights of the group's product rollout:

- A UNIX-based LAN Manager/X network operating environment, a complete rewrite of Microsoft Corp.'s LAN Manager.
- An office automation software package called Rhapsody. Using it, a customer can choose his or her own word-processing, spreadsheet and other standard applications but work within a Rhapsody framework rich with features like global messaging and document management.
- A network server, dubbed StarServer E, that brings together a computer operating system (UNIX System V release 4) and a network operating system (LAN Manager) on a symmetric-multiprocessing





machine built with 80486 microprocessors.

- A UNIX-based database server, made by Pyramid Technology Corp. and marketed by AT&T as the System 7000. It's based on reduced instruction set computing (RISC) architecture.
- A RISC chip upgrade to AT&T's established line of 3B2 midrange systems. Upgrading the systems with Mips Computer Systems Inc.'s R3000 RISC chips doubled the 3B2's price/performance ratio over previous models.

Although 1990 was a busy year on the product side, it was another year of red ink in the accounting department. AT&T does not disclose its Computer Systems Group revenues, but analysts estimate that the firm lost $300 million, in the computer business last year.

Despite losing money in computers, AT&T won some big customers in 1990. United Parcel Service ordered $29 million worth of networked PCs from AT&T. National Railroad Passenger Corp. signed a $14 million contract with the company to install and maintain 2,100 networked computers at 300 Amtrak stations. AMR Corp.'s American Airlines Inc. subsidiary tapped AT&T for a multimillion-dollar extension to its Semi-Automated Business Reservation Environment (SABRE) reservation system. AT&T also scored multiple wins in the hotel industry.

Clearly, however, AT&T has opted to buy its way out of the loss column in computers. Although AT&T continues to develop its own products for introduction in 1991 and beyond, its chief product strategy is to buy NCR. If its takeover of NCR is successful, (NCR has agreed in principle) AT&T intends to leave much of the Dayton, Ohio, company's computer and software lines intact, says AT&T vice president William T. O'Shea.

Both AT&T's 3B2 and NCR's Tower lines of UNIX servers and midrange systems will stay. So will AT&T's System 7000 and StarServer FT, the latter a fault tolerant machine made by Tandem Computers Inc. that AT&T remarkets. The StarServer E, however, is likely to displace comparable models in NCR's 3000 line.

On the software side, AT&T's Tuxedo monitor looks like the overall winner for transaction-processing applications. Rhapsody and NCR's Cooperation software each has its strong suits, O'Shea says, suggesting that the two products may be merged.—*Mark Schlack*

ELECTRONIC DATA SYSTEMS CORP.

7171 FOREST LANE
DALLAS, TX 75230
(214)-661-6000

RANK
9
IS REVENUE
$2.87 B

In 1990, Electronic Data Systems Corp. swung for a home run but settled for a solid double down the line.

One of the leading providers of outsourcing and systems integration services put together a pair of deals that—had they survived—would have given EDS both an immediate bottom line boost and direct participation in two key new markets: insurance and air transportation. The most significant deal was one for EDS to buy 50% of Continental Airlines Holdings Inc.'s System One computerized reservation system and to provide data services for the system for 10 years. EDS valued the agreement at up to $4 billion.

The second deal would have given EDS a similar 50% ownership of insurance holding company Westwood Equities and a $250 million, 10-year outsourcing contract with its Ticor Title subsidiary.

The Westwood deal, however, fell through, and the Continental purchase went into suspended animation when the air carrier filed for protection under Chapter 11 of the Federal Bankruptcy Act. So those two major contracts produced little more than legal bills for EDS in 1990. This year, however, EDS did conclude the outsourcing part of the Continental deal, valued at $2.1 billion.

And the company managed to produce solid revenue and earnings gains in 1990, particularly in that part of the business not dependent on parent General Motors Corp. Non-GM revenue was up by about 16.7% in 1990 to $2.87 billion, while GM-related business grew 7.56% to $3.01 billion. Overall earnings grew by 14.2% to $496.9 million.

EDS senior vice president Gary J. Fernandes attributes the non-GM revenue increase to EDS's ability to gain customers in new markets, grow business outside the United States and weather the recession by convincing customers to outsource IS services as a way to save money. "In tough economic times, people have some strong motivations to come to us. That's what's been happening," says Fernandes.

The company gained ground in unfamiliar markets, inking an outsourcing contract with Lockheed Space Operations Corp. to operate a data center at the Kennedy Space Center. EDS also linked up with food services firm Morrison Inc.

IS international business grew from 15 to 18% of revenues in 1990. Fernandes calls that figure "still far too low," but says that the company continues to invest in international networks and data centers that should lay the groundwork for future international business growth. In 1990, EDS did sign a new $300 million outsourcing agreement with Saab-Scania AB and service agreements with the U.K.-based Midland Bank PLC and Bancomext SA in Mexico.

Although EDS posted healthy revenue figures, non-GM growth of 16.7% was down radically from the 32% the company reported in 1989. Analyst Doug Wilder of Mountain View, Calif.-based Input Inc. attributes the dip in part to increased systems integration and outsourcing competition from formidable new market entrants such as Andersen Consulting and IBM. Wilder notes that those competitors, unlike EDS, have had strong international operations for many years.

Fernandes acknowledges that EDS is facing increasing competition for outsourcing and systems integration revenue. But, he says, EDS management still expects to grow its non-GM revenues by at least 18% in 1991.—*Jeff Moad*

XEROX CORP.

800 LONG RIDGE ROAD
STAMFORD, CT 06904
(203)-968-3000

RANK
10
IS REVENUE
$2.80 B

For years, Xerox Corp. has copied its own success, over and over again. But, like copies, over the years Xerox's success with its mature technology has been fading.

For the past few years, Xerox has been trying to change its image to that of a "document company" in order to broaden its appeal within the information technology industry. To date, it hasn't been very successful. Despite modest gains of 9.7% in document-processing revenues to $13.6 billion from $12.4 billion in 1989, overall earnings in 1990 dropped 65% from the year before.

The amount of that revenue that's IS related remained the same as it was last year, at $2.8 billion. Earnings from document processing were $599 million in 1990, up 23% from $488 million in 1989. The company's revenues as a whole, however, grew only 4.7% from $17.2 billion in 1989 to $18.0 billion last year, as document-processing growth was offset by extremely poor performance in Xerox's financial services businesses.

In March, Xerox wrote off $375 million when it discontinued VMS Realty Partners, its troubled real estate business. Later in the year, it also sold its ailing auto insurance operations to a subsidiary of General Motors Corp. And, although it also sold its South Pacific document-processing operations to joint venture Fuji Xerox Co. Ltd. for a total of $410 million, the company will continue to focus on document processing: copiers; printers; workstations; and so-called collaborative-publishing software, which enhances the ability of teams of authors to work on one document.

To revitalize the company, president and chief executive officer Paul A. Allaire, who took over from eight-year veteran CEO David Kearns in August, is furthering Xerox's efforts to change its image with an aggressive product development campaign. In October, Xerox announced the first in a series of multifunction printers, the Docutech Production Publisher—the company's most significant and expensive product announcement in years. Some analysts speculate that Xerox, known to spend $800 million a year on research and development, may have spent $1 billion in R&D to build Docutech.

Along with the new $220,000 do-everything machine, which combines printer, copier and scanning technology, went a stepped-up advertising campaign designed to reposition the company. The added exposure reaped some benefits by the fourth quarter, in which document-processing revenues were up 9% over the same period in 1989.

In July, Xerox signed a $200 million contract to resell Sun Microsystems Inc.'s SPARC-based computers, in an expected move that acknowledged the failure last year of its own proprietary workstations to gain significant market share. And although it won't say when, Xerox will port its software to platforms other than Sun's sometime in the near future.

The Sun deal followed a series of smaller software agreements in which Xerox shed some technology and picked up other products. In February, Computer Associates International Inc. assumed the rights to Xerox Presents and Xerox Graph software, an option CA gained when it acquired Cricket Software Inc. from Xerox in June 1989. In March, subsidiary Xerox Desktop Software Inc. acquired Ventura Software Inc. of Salinas, Calif.; the following month, it signed a deal with Digital Research Inc. to license DRI's GEM windowing environment.

Those agreements were only the beginning of what William C. Lowe, executive vice president in charge of development and manufacturing, says will be a continuing challenge in 1991: opening up Xerox technology and partnering with other companies. In October, Xerox announced partnerships with a raft of companies, including Adobe Systems Inc., Andersen Consulting, AT&T, Digital Equipment Corp., Ernst & Young, Novell Inc. and Unisys Corp.

Perhaps the most significant of those partnerships is with Novell. Sometime this year, Xerox will come out with a version of Docutech that connects to PCs, Apple Macintoshes and workstations via Novell NetWare-based local area networks. That interconnected product will be one of many new products in 1990 and 1991, the hoped-for results of closer ties between Xerox's Palo Alto Research Center (PARC) and Xerox's product managers. Xerox has tightened these relationships over the last two years, says Lowe, "in order to, frankly, get the technology out of PARC, out of research and into our customers' hands faster."

—Elaine L. Appleton

SUN MICROSYSTEMS INC.

2550 GARCIA AVENUE
MOUNTAIN VIEW, CA 94043
(415)-960-1300

RANK
11
'90 REVENUE
$2.76 B

The phenomenal success enjoyed by Sun Microsystems Inc. in 1990 belies the challenges ahead of the nine-year-old company. There's little time at Sun these days to gloat over what by every conceivable measure was an outstanding performance last year. Earnings tripled to $151 million. Revenues expanded more than a third to $2.76 billion on the strength of Sun's all-wood-behind-one-arrowhead strategy—focusing on a single architecture, operating system, network standard and graphical interface.

What's keeping Sun from properly enjoying such triumphs is competition in technology and marketing. In computing horsepower, Sun's family of Scalable Processor Architecture (SPARC) products are threatened in price and performance by several other products based on reduced instruction set computing (RISC) designs—notably IBM's RS/6000 workstations, Hewlett-Packard Co.'s new HP-PA line of workstations and Mips Computer Systems Inc.'s Sun-compatibles. In marketing, Sun faces three broad challenges. One is to combat the sheer force of IBM, HP and Digital Equipment Corp. (one of Mips's customers). Another is to fight the image that Sun no longer sells open (standards-based) systems. Yet another is to stop personal computer suppliers from taking the high ground in client/server computing.

"The Big Lie. That's what I call all of this nonsense about being a proprietary systems supplier," says chief executive officer Scott G. McNealy, refuting charges that Sun's refusal to back technologies endorsed by the Open Software Foundation is tantamount to being closed minded. "Just because I won't pay taxes to IBM, HP and DEC [OSF's main U.S. constituents]—that's why I'm not open?" the CEO asks in visible disgust. Volume shipments and a willingness to license technology is what creates a standards setter, he argues.

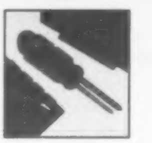
Sun last year sold nearly 150,000 systems itself—the basis for McNealy's claim that the company's SPARC design captured 70% of the market for all RISC-type chip shipments in 1990. SPARC licensees, such as Solbourne Computer Inc. and Toshiba Corp., contributed little to Sun's RISC battle last year, but they and the two dozen other SPARC licensees are expected to become a bigger factor this year in holding off IBM, HP, Mips and others.

The bulk of Sun's revenues in 1990 came from its SPARCstations, whose low-end models (the SLC at $4,995, the IPC at $7,995 and the 2 at $14,995) compete more than effectively in performance against high-end personal computers, especially now that popular PC-based software packages like Lotus 1-2-3 are available for them. But more and more sales are also coming from the company's SPARCservers. McNealy estimates as much as $1 billion of Sun's 1991 revenues are coming from server-class machines.

The closest Sun comes to disclosing (in dollar terms) its customer segments and channels for reaching them is to say that half of the company's sales in 1990 stemmed directly from users and half came from resellers. Among its more important resellers are these DATAMATION 100 members: Intergraph Corp., Mentor Graphics Corp. and Mitsubishi Corp. Last year, all signed multiyear contracts valued at $150 million or more to resell SPARC systems with their own software.

One commercial avenue where Sun's systems continue to land is Wall Street. Bear, Stearns & Co. Inc., which began installing the company's workstations as long ago as 1987, remains bullish on Sun. But the senior managing director of information services for the brokerage firm is quick to add: "I don't care whose machine it is. As long as it is AT&T UNIX-compliant, I'll buy it."

Mindful of the challenges of winning and maintaining customers like Bear Stearns, McNealy has created a new corporate organization for managing his company's increasingly complex business. Effective in two



weeks, customers of Sun will see three spheres instead of one. SunSoft Inc. will license operating system software and other system software products to resellers. SunTech Enterprises Inc. will make and market to resellers and users tools, networking software, peripherals and other add-on products for Sun's and the SPARC licensees' platforms. Sun Microsystems Inc. will develop, make and market SPARCstations and SPARCservers to all types of customers.

"We broke a little glass," is how McNealy describes his new organization, which broke down some existing structures within his company. Whether the new Sun is as smashing a success as the old one depends on how well it meets the hurdles placed in its way by technology and competition.—*Tim Mead*

SEAGATE TECHNOLOGY INC.

920 DISC DRIVE
SCOTTS VALLEY, CA 95067
(408)-438-6550

RANK 12
IS REVENUE $2.67 B

A strategy emphasizing production efficiencies over innovative technologies made Seagate Technology a success in the 1980s. But it cost the largest independent disk drive manufacturer in the first year of the 1990s.

Although Seagate Technology's revenues last year expanded nearly 50% to nearly $2.67 billion, much of the gain came from an acquisition, rather than internally generated growth. (A full year's worth of financial results from the Imprimis Technology Inc. disk drive business acquired in 1989 from Control Data Corp. landed on Seagate's balance sheet in 1990.) Eclipsing Seagate's performance were innovative upstarts Conner Peripherals Inc. and Quantum Corp. Conner Peripherals's revenues expanded 90% to $1.34 billion last year, and Quantum's revenues rose 82% to $716 million. These successes were largely the result of the two companies' pioneering efforts in new 3½- and 2½-inch drive formats for storing information.

Seagate could not follow its two rivals quickly enough in the race to win disk drive orders from portable, notebook and other PC makers that preferred drives smaller than 5¼ inches, the company's traditional forte. As a result, net income at Seagate fell roughly 5% to just under $100 million in 1990. Now, however, Seagate is working hard at becoming a technology leader instead of a follower.

In 1990, Seagate introduced a barrage of new products, including additional 3½-inch drives, the company's first 2½-inch product and new high-capacity 5¼-inch drives. Seagate also entered into alliances with Cray Research Inc. and NCR Corp. to build high-performance storage devices with greater capacities and data transfer rates. Cray is already marketing a proprietary version of one of those products with its supercomputers, and NCR is incorporating an integrated disk array into several of its systems.

Seagate's efforts in high-capacity drives are based on Imprimis's technology. Seagate is both the market and technology leader in disk drives holding over 1 gigabyte of information, claims Garrett A. Garettson, the company's vice president for product strategy.

Peripheral revenue from the top 100 North American companies grew 18.9% in 1990.

However, at lower levels of storage, Seagate lags. Both Conner Peripherals and Quantum were well ahead of Seagate in shipping their first 2½-inch drives. In this area, Seagate also faces competition from new entrants such as Maxtor Corp. and Western Digital Corp., as well as an expected onslaught from Japanese manufacturers. Toshiba Corp. announced its first 2½-inch drive in September. Meanwhile, margins in the 3½-inch market are becoming razor thin. Prices on 40-megabyte 3½-inch drives fell some 36% to below $200 last year, according to analysts who follow the market.

Seagate must achieve greater marketing success for its technology efforts to pay off. The company will need to win contracts to supply drives to high-flying computer manufacturers and also maintain the sizable business with IBM that it already enjoys. Seagate's two biggest competitors are riding high fliers, with Conner Peripherals aboard Compaq Computer Corp. and Quantum atop Apple Computer Inc.—*Joe Kelly*

WANG LABORATORIES INC.

1 INDUSTRIAL AVENUE
LOWELL, MA 01851
(508)-459-5000

RANK 13
IS REVENUE $2.36 B

Rare is the company that can lose $665 million in a single year and argue convincingly that its health has improved. Wang Laboratories Inc. belongs to that rare breed, although its prospects for survival are hardly assured.

The company last year cleaned up its balance sheet, satisfying bankers and brokers vexed by Wang's past borrowing practices and its overhead costs. It continued to bring in new management, restoring a level of competence to its executive ranks that had been absent for years. And it began to deliver standards-based products, carrying out its open systems promises.

What Wang didn't do in 1990, however, was attract a significant number of new customers or stem all defections from its existing customer ranks. One-third of Wang's customers surveyed by DATAMATION and Cowen & Co. last fall indicated they were considering a switch to a new midrange systems supplier.

In the absence of both new accounts and absolute fidelity among existing users, Wang's revenues declined around 12% from $2.70 billion in 1989 to $2.36 billion in 1990. The company's losses, meanwhile, widened from $511 million to $665 million—mostly due to restructuring costs incurred during the first half of 1990.

But in the second half, Wang's losses shrank to $22.1 million. And besides almost stanching the flow of red ink, Wang ended 1990 with a much stronger asset base, having $100 million more in cash on hand and a $100 million less in accounts receivable than in the previous year. Moreover, its operating costs were down almost $500 million on an annualized basis, mostly due to the head count reductions. The ranks of Wang employees shrunk from 29,000 to 20,184 between 1989 and 1990.

It's the product set, not balance sheet, that will prove Wang's doing or undoing in 1991. Chief executive officer Richard Miller; executive vice president and Unisys Corp. veteran Joseph Tucci; and the other half-dozen executives plucked from competitors Control Data Corp., Digital Equipment Corp., Hewlett-Packard Co. and elsewhere are going to have to deliver on promises made to users that Wang can transform itself from a maker of proprietary minicomputers to a supplier of PCs, workstations, networks, servers and software that comply with industry standards.

To date, most of Wang's standards strategy has revolved around hardware built atop the Intel Corp. 80X86 PC/server architecture and software linked to other companies' popular platforms. In mid-1990, for example, Wang introduced the PC 480-25C, a $8,595 machine based on Intel's 80486 chip and designed for server, UNIX multiuser and workstation applications.

More recent evidence of Wang's commitment to standards came in April 1991, when it introduced several software products that allow users to control image processing on Wang VS midrange systems or PCs via IBM or IBM-compatible mainframe systems. The company also made it easier for users to integrate Wang imaging systems with Apple Computer Inc.'s Macintosh systems and with Microsoft Corp.'s Windows-based applications.

And any day now users should see UNIX systems from Wang based on reduced instruction set computing (RISC) technology supplied by Mips Computer Systems Inc. They'll be rolled out under Wang's Office 2000 banner, a high-profile marketing campaign aimed at persuading users that its new and future products hold the potential to raise white-collar productivity. "Whether it's too little, too late remains to be seen," says George Ellis, a securities analyst with Merrill Lynch & Co. Inc. in New York City.

"Wang realizes that's where it has to go," says Wang customer Donald Lucas of the supplier's move to standards—a direction in which his own company is also headed. The vice president of information systems at Otis Elevator, a Farmington, Conn.-based subsidiary of United Technologies Corp., also agrees with Miller's decision to focus Wang's efforts on systems for work group and departmental-computing users and not on full-bore enterprise solutions. "If you're resources are limited, you can't be everything to everybody," Lucas says. "Wang also realizes that it won't be a user's only computer supplier."—*Tim Mead*

AMDAHL CORP.

1250 EAST ARQUES AVENUE
SUNNYVALE, CA 94088
(408)-746-6000

RANK
14
IS REVENUE
$2.16 B

The period beginning in 1990 and stretching into 1991 may be remembered as the most challenging time in Amdahl Corp.'s history.

IBM introduced its first new mainframe architecture in many years and joined the ranks of price cutters. The worldwide economy was unsettling. And Amdahl decided to push into the world of UNIX and open systems.

Those challenges took their toll on the firm's 1990 financial results. Although Amdahl increased its customer base by 15% in 1990 to over 1,800 sites, its revenues remained essentially flat at $2.16 billion.

Reduced manufacturing and other expenses helped Amdahl increase earnings by 20.2% to $184 million. But compared with 1989, Amdahl's processor revenues for the year actually dropped, as the company was forced to discount its older 580 and 5890 mainframes by 40% and more to keep up with IBM price cuts. Amdahl president E. Joseph Zemke says he expects discount pressure to continue unabated through much of 1991.

Amdahl may not enjoy firmer prices until the end of this year, when the company finally begins to ship its newest mainframe generation, designed to compete with IBM's new generation of ES/9000 processors. Amdahl called the new 599 5 series of mainframes, which it announced in September, the most significant announcement in the company's history.

The family includes four models with 35 million instructions per second (MIPS), 7-nanosecond processors. The largest of that group, an eight-processor configuration, lists at $27 million and is rated at 328MIPS. That performance far exceeds the largest ES/9000 system. The problem for Amdahl is that it won't start shipping its largest machines, the M series, until sometime between the fourth quarter of this year and the second quarter of 1992. That will put the company significantly behind IBM.

Amdahl continued investing in open systems software, specifically UTS, its mainframe-based version of UNIX System V. In 1990, the company unveiled version 2.1 of UTS, the third major release of the operating system. The company also agreed to license from Sun Microsystems Inc. its Scalable Processor Architecture (SPARC) reduced instruction set computing (RISC) microprocessor architecture, opening the door for Amdahl to enter the market of UNIX- and standards-based servers. The company plans to move UTS to a new RISC platform.

Although Amdahl's push into UNIX has yet to win it big revenue increases, the company has picked up a few new hardware customers. One last year was Marshfield Clinic in Marshfield, Wis., which signed a $5 million contract to install an Amdahl mainframe running UTS to support over 1,000 commercial applications.

However, Amdahl's new UNIX business probably will not be enough to overcome the effects of ongoing economic uncertainty and a major mainframe product transition. In early 1991, Amdahl joined IBM in warning analysts of lower earnings. According to Zemke, much of Amdahl's weakness has been centered in the European market. He says Amdahl may see an improvement in its business in the second half of this year, but he's "not ready to call it a recovery yet."—*Jeff Moad*

TANDEM COMPUTERS INC.

19333 VALLCO PARKWAY
CUPERTINO, CA 95014
(408)-285-6000

RANK
15
IS REVENUE
$1.87 B

Tandem Computers Inc. is struggling with the effects of recession. The company's major customers—banks and other financial institutions that rely heavily on its various fault tolerant systems for their on-line networks—are putting a lid on capital spending. That has put pressure on Tandem's revenues, which grew by only 11.7% in 1990, down from 18% in 1989. U.S. sales growth was particularly low, dropping to 8% from 23%.

Net earnings suffered even more, falling 16.7% to $98.1 million. As the economy worsened during the year, Tandem's earnings suffered steadily, culminating in the last quarter's plummet to just over $7 million, compared with $30.7 million for the same quarter of the year before.

If there was some good financial news, it was the spectacular growth of Tandem's Japanese business. Annual revenues there have grown more than sixfold over the past five years, topping $140 million in 1990. Japan is now Tandem's single largest non-U.S. market, accounting for about 7% of total revenues. Tandem won some high-profile Japanese sales in 1990, including ones to Nippon Steel, Sumitomo Trust & Banking and Toyota Motor Corp. But Tandem also faces potentially serious competition in Japan from Fujitsu Ltd., which has begun marketing its own fault tolerant system, the Sure System 2000.

Despite the recession, Tandem is following through on strategies it has been developing for several years: diversifying into markets outside banking and finance, beefing up the performance of its hardware and converting its systems to reduced instruction set computing (RISC) hardware and an open systems environment based on the UNIX operating system.

Two actions in 1990 illustrate Tandem's approach to this economic downturn: the announcement of the Tandem Integrity S2, Tandem's first UNIX machine, and the purchase of Array Technology Corp., a small company specializing in storage technologies. Integrity was a milestone for Tandem, giving it a fault tolerant UNIX product. That may not win the company immediate orders in its traditional financial markets, but it should give the firm an entrée into telephone companies and government agencies.

The purchase of Array Technology will

help Tandem maintain a performance edge its hardware will need to remain competitive in the era of open systems. Through Ungermann-Bass Inc., which Tandem purchased in 1989, Tandem has already shored up its ability to provide standards-based connectivity solutions.

In January of this year, Tandem introduced its NonStop CLX 800 series, a midrange system offering a 55% performance kick over the older CLX 700. According to Gartner Group Inc., the Stamford, Conn.-based market research firm, Tandem is leaning on sales of the CLX to make up for slow sales of its high-end Cyclone line. But the CLX 800 may cut into low-end Cyclone sales, according to Gartner.

Robert T. Jolls, Tandem's vice president of product marketing, maintains that sales of Cyclone are strong and will do better as customers develop applications for the high end of the Cyclone line. According to Jolls, Tandem will introduce a RISC-based version of CLX this year. The firm will port its proprietary Guardian operating system to the new model, maintaining compatibility with applications written for pre-RISC CLX machines.—*Joe Kelly*

TRW INC.

1900 RICHMOND ROAD
CLEVELAND, OH 44124
(216)-291-7000

RANK
16
IS REVENUE
$1.85 B

TRW Inc., an $8 billion conglomerate focused mainly on the defense and automotive industries, spent a good part of the 1980s building up its presence in software and systems. Much of this effort has come from within its huge Space & Defense group.

Last year, Space & Defense contract work accounted for the lion's share of TRW's $1.85 billion in IS revenue during calendar year 1990, up almost 13% from the year before. Despite a shrinking national defense budget, Space & Defense managed to land a number of important contracts, including one from the National Aeronautics and Space Administration (NASA) to develop a design for the Advanced Tracking and Data Relay System and a $139 million Federal Aviation Administration contract to modernize the U.S. air traffic control system.

Outside Space & Defense, TRW's IS business is focused within the Information Systems and Services (ISS) group. Consumers and companies outside TRW are most familiar with this group's extensive consumer credit and real estate database services. Credit-based revenue, which does not qualify for ranking purposes in the DATAMATION 100 survey, accounted for the majority of the group's $760 million in 1990 revenue. Slightly over half that amount was generated by what had been the Chilton Corp., a Dallas-based credit agency that TRW acquired in 1989. Last year, the company combined Chilton's database products with its existing customer credit capability and created a popular—and profitable—national credit file service.

Another side of ISS, TRW Financial Systems, is involved in systems integration. This group specializes in building imaging systems for large financial customers and works closely with a number of imaging hardware vendors, including Eastman Kodak Co. and IBM.

Since 1984, ISS has been growing at an annual compound growth rate of approximately 21%. Last year, however, ISS revenue slowed to about 8%, with operating profits falling to $49 million from $60 million in 1989. Management attributed the problem primarily to two troublesome divisions: the Customer Service Division (CSD), which provides third-party maintenance and repair of computer and electronic equipment, and the Information Networks Division (IND), which provides local area networks to government installations. Claiming CSD did not fit its long-term strategy, TRW sold the division early in 1991. It also reduced the size of IND and transferred its operation to Space & Defense.

More critical to ISS's long-term outlook is building up its systems integration business overseas. To that end, ISS signed its first European contract last year with BBS, a consortium of major Norwegian banks. The contract was for an image-processing system similar to those installed at ISS customers American Express Co., Citibank N.A. J.C. Penney Co. Inc. and New York Life Insurance Co.—*Paul Pinella*

ANDERSEN CONSULTING

69 WEST WASHINGTON STREET
CHICAGO, IL 60602
(312)-580-0069

RANK
17
IS REVENUE
$1.75 B

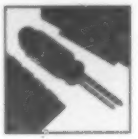
The decision by the partners of Big Six accounting firm Arthur Andersen & Co. SC to spin off its systems integration business in 1989 paid off handsomely in 1990. It was the first year Andersen Consulting stood apart from the tax and audit practice, now known simply as Arthur Andersen. Andersen Consulting's IS revenues of $1.75 billion were up an impressive 43% over last year's $1.22 billion figure. And while managing partner George T. Shaheen declined to discuss the company's 1990 earnings, he is confident that his team can grow these revenues 15 to 30% this year.

The source of most of Andersen Consulting's business—as well as all of number one competitor Electronic Data Systems Corp.'s $6 billion in sales and a growing chunk of IBM's $69 billion revenues—is systems integration. Shaheen defines an integrator as a prime contractor whose job is to bring together products from different hardware, software and networking suppliers to solve a problem or create an opportunity for the client company. To do this, Andersen is seeking to widen its alliances with other DATAMATION 100 suppliers and to sharpen its own software product offerings where its allies lack expertise.

Two allies out of Andersen Consulting's two dozen stand out in Shaheen's mind: Digital Equipment Corp. and Microsoft Corp. With Microsoft's Windows graphical user interface environment, LAN Manager network operating system and cadre of desktop software packages, Andersen Consulting aims to help big user organizations build client/server applications. With Digital, the firm intends to enhance the value of Digital's VAX systems in commercial environments, giving programmers software tools with which to work.

Those tools—among them are Method/1 and Plan/1—fall under a family of computer-aided software engineering products that Andersen Consulting calls FOUNDATION. The firm's other software products are applications: its MAC-PAC series is aimed at manufacturing needs, and DCS products are distribution applications. Shaheen points out that these products exist really to further the cause of Andersen Consulting's systems integration business. "We are not inventors of technology," he stresses. "We sell what others build. Time to market is the name of the game with us."

The firm's timing in 1990 worked well for Sun Refining and Marketing Co. The $8 billion Philadelphia-based subsidiary of Radnor, Pa.-based oil company Sun Co. Inc. found itself in an unusual position last year of having 40% unused mainframe capacity at its Dallas data center, the result of selling off an exploration group that had used the center's IBM machines for seismic number crunching. "We thought that if we could find someone financially strong that was in need of this asset, we could sell it and lease back services



from it," recalls Jack Donohue, director of information systems at the marketing subsidiary. After getting bids from three major systems integrators, he cut a deal with Andersen Consulting. Andersen got the data center, its 70 employees and a 10-year contract to supply Sun with its remaining processing needs.—*Tim Mead*

AUTOMATIC DATA PROCESSING INC.

1 ADP BOULEVARD
ROSELAND, NJ 07068
(201)-994-5000

RANK 18
IS REVENUE $1.73 B

Computer services giant Automatic Data Processing Inc. last year executed a new strategic plan that called for providing a broad range of services in four business segments. Results were mixed.

ADP's total revenues inched up only 3% to $1.75 billion during the year, partly due to divestitures, as well as to slowdowns in some sectors. It was the second year in a row revenues fell below historic double-digit increases.

The strategy to provide a broader, and more integrated, set of services in the four business segments—Employer (payroll), Dealer, Automotive Claims and Brokerage services—began to be fleshed out last year, as ADP introduced new products and services in several areas. In Dealer Services, for example, ADP brought out a product in September called LaserStation. It uses Hewlett-Packard technology to supplement ADP's accounting, inventory and other service offerings by providing printed forms for auto dealers.

"I think we're on plan," says Arthur F. Weinbach, senior vice president of finance and administration. "As we go about identifying incremental services, we look at the transaction chain and try to take advantage of existing client relationships."

Financial performance in the four business segments ranged from good to disappointing. Automotive Claims Services racked up a 9% increase in revenue last year, a decline from the double-digit growth rates achieved previously.

Employer Services revenues grew about 15% overall, the same as last year. The National Accounts part of this business, which covers companies with 500 to over 50,000 employees, chalked up a 10% growth rate in 1990. One of the major wins for the company during the year was a 60,000-employee payroll contract, its largest to date, with Hyatt Hotels And Resorts. Growth in Employer Services, however, is being offset by recession-induced declines in both payroll size and frequency.

Dealer Services had high single-digit growth in revenues but, to the company's disappointment, did not increase the number of new sales compared with those made in the prior year. ADP did roll out new Motorola reduced instruction set computing (RISC)-based machines to replace the M4000 minicomputers it places at customer sites. ADP also signed an agreement with Chrysler Corp., under which ADP provides an exclusive nationwide parts locator service to about 5,000 Chrysler dealers.

Information services revenue from the top 100 North American companies grew 13.7% in 1990.

Brokerage Services revenues dropped about 7% between July and December last year due to the continued downturn on Wall Street. This compares with a 10% decline in all of 1989. This business, in which ADP has poured nearly $190 million in capital expenditures over the past three years, has not achieved the kind of return management had expected. "Brokerage is clearly not a growth business today," says ADP chairman Josh S. Weston.

"The ROI here is lower than we would like," adds Weinbach. "But we expect to see it out."

ADP continued pruning businesses that didn't fit the company's core business segments. The firm sold its Manufacturing Services business and 81% of its Brazilian data-processing business. As a result, overall head count dropped to 19,000 from 20,000.—*David R. Brousell*

COMPUTER SCIENCES CORP.

2100 EAST GRAND AVENUE
EL SEGUNDO, CA 90245
(213)-615-0311

RANK 19
IS REVENUE $1.68 B

This power in federal systems integration had a good year overall in 1990. Both revenues and net earnings climbed 16% in 1990 over their 1989 levels. CSC's two major nonfederal operating units, the CSC Consulting Group and the Industry Services Group, scored 56% (20 to 25%, if acquisitions are not counted) and 34% revenue gains, respectively, in 1990, making major contributions to growth.

The Systems Group, CSC's federal business unit, chalked up only a 3% gain in revenue to $1.94 billion, but generated $1.2 billion in new contract orders, the revenue impact of which will be felt primarily in years to come. CSC says it won about 50% of the contract dollars it bid on in 1990, compared with only a 25% win rate in 1989.

In government business, major wins included a $94 million systems integration contract from the U.S. Treasury Department for cash flow and check-processing services; two contracts totaling $168 million from the General Services Administration for applications and services in the Pacific Rim; and a $347 million contract from the Environmental Protection Agency for a broad range of IT services.

Federal success is no real surprise for CSC. The real test of the game plan it formulated a couple of years ago is outside the federal arena, particularly in the commercial arena. In 1986, CSC's federal business accounted for 70% of revenues and 80% of earnings. But last year, CSC reached its goal of nonfederal revenues representing 40% of overall company revenues and 50% of earnings. Companies signing with CSC in 1990 included Bay State Health Care, for administrative systems; Boise Cascade Office Products Corp., for a distribution system; and Sterling Drug Inc., for reengineering its information systems.

Still, CSC is not yet perceived as a major player in the commercial arena. Says Andrew Brosseau, an analyst with Cowen & Co. in Boston: "CSC's federal business got better, but commercial hasn't gone as smoothly. The margins are bad. But it's a big opportunity if CSC can get it to go. They should adopt more of an industry focus than a functional focus."

William R. Hoover, CSC chairman and president, says he's quite satisfied with the company's efforts so far to develop vertical market expertise, particularly in the distribution, materials-handling and manufacturing sectors. He says, though, that CSC needs to build its capabilities in the retail and banking industries.

Another important part of the commercial thrust is to create synergy among CSC's business groups to satisfy requirements of commercial customers. CSC also wants to leverage the consulting expertise of such units as Cambridge, Mass.-based Index Group Inc.

CSC last year nailed three contracts that, it says, show the synergies are working. For example, CSC's Cleveland Consulting Associates Inc. and CSC Partners Inc. are teaming up to develop a distribution system for eyeglass retailer Pearle Inc., and specialty steel maker Weirton Steel Corp. hired Index Group to develop an integrated manufacturing information system.

"I'm not easily satisfied, but I'm pleased," says Hoover, of the company's efforts so far in the commercial market. "The amount of effort in the commercial market has really been quite strong."

—*David R. Brousell*

PRIME COMPUTER INC.

PRIME PARK WAY
NATICK, MA 01760
(508)-655-8000

RANK 20
IS REVENUE $1.59 B

The world is already a tough place for companies that make proprietary midrange computers, but for Prime Computer Inc. the environment has been particularly unfriendly.

When 1990 started, Prime was still reeling from the hostile takeover bid by MAI Basic Four Inc. (now MAI Systems Corp.), a series of layoffs and a fast shuffle of top management that brought three successive presidents to the helm. The dust finally settled last year under the ownership of the New York City-based venture capital firm J.H. Whitney & Co., but the view that emerged wasn't pretty. Prime simply hadn't kept up with its competitors.

The rollout of new minicomputer models within the 50 series slowed to a trickle. With just three new systems introduced over two years, IS directors at last year's National Prime User Group (NPUG) annual meeting expressed anxiety about remaining overly reliant on Prime's flagship line.

Prime faces similar problems on the software side of the house. The company's acquisition of Computervision Corp. in 1988 made it the second largest computer-aided design/manufacturing (CAD/CAM) vendor in the world, behind IBM; according to the Framingham, Mass.-based research firm International Data Corp. After two years of diverting resources to other battles, Prime dropped to fifth position in the CAD/CAM market.

One explanation for the fall is simple. Parametrics design capability, a software feature that allows designers to track the relationship between various parts, became a prerequisite for success in the CAD/CAM market. And Prime didn't have it.

However, Prime isn't inclined to lie down and wait for the undertaker. The company was restructured last year into five independent business units. As separate profit-and-loss centers, the new units are designed to react more quickly to changes in the market.

At the NPUG meeting, a new 50-series system was unveiled, based on complementary metal oxide semiconductor (CMOS) technology. It was the first major change in the company's underlying technology since 1984, when Prime moved to emitter-coupled logic (ECL) circuits.

Parametrics technology is promised in the next Computervision release. And a Digital VAX version of Computervision's software is rumored as one of the first visible signs of influence by Prime's new president, John (Jack) J. Shields, the former Digital vice president.

In October, the company moved to shore up its weak position in the open systems market with the announcement of a partnership with Mips Computer Systems Inc. of Sunnyvale, Calif. The EXL 7000 series, a line of new UNIX machines based on reduced instruction set computing (RISC) technology, was the first offspring of that marriage.

Earlier in the year, Prime announced a UNIX version of its profitable Information database management software. About 40% of the installed base of 23,000 50-series computers run PICK-based Information software. With 20% of the total PICK market, Prime is the market leader and is well positioned to help customers integrate PICK and UNIX and make the transition toward open systems. With the introduction of a RISC line, Prime is hoping for new accounts, as well.

All in all, 1990 was a rebuilding year for Prime; 1991 should reveal whether the firm's struggle to catch up with a changing market can be successful.—*Chris Sivula*

MICROSOFT CORP.

1 MICROSOFT WAY
REDMOND, WA 98052
(206)-882-8080

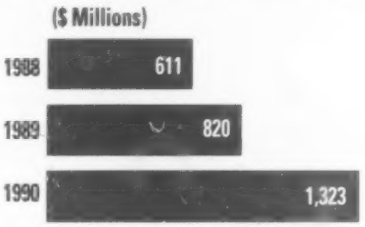
RANK 21
IS REVENUE $1.48 B

If Microsoft Corp. ever puts 1990 industry clippings into a time capsule, what future historians will read about most will be Windows, Windows, Windows.

Microsoft's Windows 3.0 graphical user interface became a phenomenal success after it began shipping on May 22, 1990. The software maker sold more than 2.5 million copies of Windows in the following six months. Analysts now expect the firm to sell 5 million copies this year and up to 8 million in 1992.

The fast-growing popularity of Microsoft's Mac-like interface among MS-DOS users is also driving sales of the company's slate of Windows 3.0-compatible software applications. Macintosh and Windows applications—principally Word For Windows and Excel For Windows—accounted for 48% of the company's revenue last year.

If new PC sales slip below the 10% growth rate that many analysts expect, Microsoft's strategy to sell Windows and Windows applications will likely succeed anyway. The reason: Windows runs under DOS, which has a base of more than 50 million DOS users worldwide, a good many of whom are likely to become Windows converts.


Microsoft's software revenue has grown 117% since 1988.

Chairman and chief executive officer William H. Gates is so confident of continued Windows success he's risked the wrath of corporate developers and fellow software manufacturers who bet the bank on Microsoft's and IBM's more advanced operating system, OS/2. He makes it clear that future versions of OS/2 from Microsoft—in particular, OS/2 3.0, a portable version specifically designed for reduced instruction set computing PCs—will support Windows and Windows applications. This contrasts markedly with OS/2 strategy statements made in the past by both IBM and Microsoft. Gates denies dumping OS/2 and defends his plans to enhance Windows.

"Corporations do have to adapt to the fact that Windows is doing a very high volume of sales, which OS/2 didn't. We're still very committed to OS/2. However, Windows is the mainstream product, and we are going to enhance the hell out of it," says Gates.

Besides its aggressive Windows drive, Gates & Co.'s major move into networking also stood out last year. Microsoft reportedly invested $40 million to $60 million last year to build a sales and marketing arm worthy of going head to head with networking heavyweight leader Novell Inc. The strategy revolves around Microsoft LAN Manager—Microsoft's answer to Novell's NetWare—and SQL Server, a server-based database management system.

The fate of the networking products is inseparable from OS/2: LAN Manager requires OS/2. Yet whether Microsoft can make meaningful gains on Novell remains to be seen, especially after IBM and Novell signed an agreement early in 1991 for IBM to sell and support NetWare. Part of Gates's strategy is to build certain LAN Manager capabilities into future operating systems, rather than leave them in the networking software.

On the international front, Microsoft's international business—much of it from original equipment manufacturers—generated 55% of the company's total sales last year. That's a trend analysts expect will continue, with a smaller increase expected in 1991.

—John McMullen

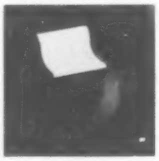
CONNER PERIPHERALS INC.

3081 ZANKER ROAD
SAN JOSE, CA 95134
(408)-456-4500

RANK 22
IS REVENUE $1.34 B

Conner Peripherals Inc. won't soon forget 1990. The company shattered all calendar year revenue records, selling $1.34 billion worth of disk drives, up 90% over 1989. The company also more than tripled last year's earnings, finishing 1990 with $130 million. In October, it won approval from the New York Stock Exchange to have its stock listed on the Big Board. And, as if that weren't enough, last year's revenue figures made Conner—only five years old—one of the fastest growing manufacturing companies in American history.

Chairman and chief executive officer Finis F. Conner says the company's phenomenal growth is a direct result of its approach to the disk drive market. He says the company doesn't try to sell existing designs to original equipment manufacturers, but instead focuses on designing custom drives to meet specific OEMs' needs. The company's philosophy may be a carryover from its inception as a disk drive supplier to Compaq Computer Corp., which once made up more than 90% of Conner's sales. Although Conner has expanded its sales to many markets, Compaq still represents 21% of Conner's revenues and owns 29% of the company. That's down from the 29% of revenues and the 32% stake in Conner, Compaq owned last year.



In 1990, Conner added to its line of 2½ and 3½-inch hard disk drives with seven new drives for personal computers, laptops, file servers, fax machines and laser printers. Based on 16-, 32-bit and reduced instruction set computing designs, the drives are being purchased by an impressive list of OEMs, including Apple Computer Inc., Compaq, Data General Corp., Digital Equipment Corp., Sony Corp. and Toshiba Corp.

The company continued to push into the European and Asian markets in 1990; those areas made up more than 56% of its total sales. Although research and development takes place in San Jose, Conner manufactures drives in Malaysia, Scotland and Singapore.

New manufacturing plants, combined with new products, swelled Conner's ranks by more than 4,000 in 1990. The company finished the year with 9,300 employees worldwide.

Despite the computer slump in the United States, analysts say record revenue and growth should continue for Conner into 1991. The company's stock earned $2.51 per share in 1990, and Wall Street expects per share earnings in 1991 to top $3.50, due mainly to increased demand for 2½-inch laptop hard disks, one of Conner's best sellers.*—Mike Ricciuti*

COMPUTER ASSOCIATES INTERNATIONAL INC.

711 STEWART AVENUE
GARDEN CITY, NY 11530
(516)-227-3300

RANK 23
IS REVENUE $1.31 B

Computer Associates International Inc. continued to work hard to pull itself together last year into what is beginning to look more like a single company offering an integrated group of products. This may not seem like such a big deal, but considering the company's growth-by-acquisition policies of the past few years, it's not to be sneezed at.

Computer Associates's chairman and chief executive officer, Charles Wang, trumpets the achievement, in fact. "Given the complexities of the marketplace and the number and types of companies we've acquired, I'm proud of what we've done over the past year," he says.

The company reached several milestones that Wang had laid out over the past couple of years to make the acquisition strategy work. As the most important one, he cites the company's commitment to integrating all of its products under a single open architecture—the CA90s architecture announced on April 30, 1990.

"We announced the CA90s architecture, and it has been a tremendous success in the marketplace, an architecture that people can understand," Wang says. He contrasts the CA90s with IBM's Systems Application Architecture (SAA), pointing out that "SAA is now three or four years old, and IBM's customers are still looking for deliverables."

Software revenue from the top 100 North American companies grew almost 14% in 1990.

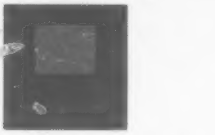
The CA90s architecture is aimed at bringing together Computer Associates's 300 or so disparate products so that they can work together on leading hardware and operating system platforms. CA is already enabling its IBM mainframe products to run under UNIX, for example, and has joined with Hewlett-Packard Co. to supply it with a complete package of systems management, database management and commercial software products over the next several months.

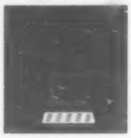
Computer Associates is already firmly ensconced in the IBM mainframe and PC world; last year CA also joined up with the Open Software Foundation and its rival UNIX International Inc., as proof of its commitment to open architectures.

Wang cites other achievements that he says show increasing responsiveness to CA customers' demands. "We are delivering what we promised last year," he says. "Our products are now in beta test for the VAX, we announced SQL capabilities for CA/IDMS and CA/DATACOM database management systems and, just as we said we would, we're shipping a PC LAN version of IDMS." All told, CA announced 70 new products, updates or enhancements last year. Only one of these—DBMS Inc.'s software management tool set—was acquired. The remainder were developed internally.

CA did take a few lumps when sales fell dramatically after the CA90s announcement. "The initial presentation of CA90s caused some confusion in the marketplace, but we're over that now," says Wang. Wang consistently has used the CA90s announcement to explain a sharp drop in sales by the company in the three-month period immediately following the announcement date.

Whether that explanation fits or not may be open to question, but last year's financial results do show strong improvement late in





the year. Overall, CA's revenue increased by a tiny 1.6% between 1989 and 1990. But in the final quarter of 1990, revenue shot up by close to 10% compared with the same period of1989.—*J. William Semich*

DATA GENERAL CORP.

4400 COMPUTER DRIVE
WESTBOROUGH, MA 01580
(508)-366-8911

RANK 24
IS REVENUE $1.24 B

Once lauded in Tracy Kidder's *Soul of a New Machine*, Data General Corp.'s reverence for technology has hurt the company in recent years. As president and chief executive officer Ronald L. Skates admits, "It's not enough to be a technology company."

Last year might have been more humbly entitled *Sold Some New Machines*, as DG booked $100 million in sales for its AViiON computers. That wasn't enough to turn the red ink to black, as the firm continued to post declining sales and earnings. But, combined with cost cutting, it did give DG a profitable fourth quarter in calendar 1990, its first since 1986.

Chief among the cost-cutting measures was a reduction in work force. Once employing almost 17,000 people, DG cut its 1990 work force of 13,700 by 3,100, or 23%, through layoffs and attrition. Another 1,400 people were gone by March 1991, reducing total employees to 9,200. Skates expects to reach his goal of 9,000 people by September, through attrition.

In the last five years, Data General suffered from defections among its 35,000 ECLIPSE MV customers, many of whom lost faith that DG would continue to support this aging line of proprietary systems. Skates says the ECLIPSE bloodletting has "stabilized." In an attempt to combat the impression that DG's commitment to open systems means declining support for the proprietary ECLIPSE, the firm set up a separate ECLIPSE business unit. That group introduced four new midrange and desktop computers in 1990.

But Skates refuses to predict whether 1991 would mark a return to the black for DG, citing worldwide economic uncertainty as a reason for caution.

He has other reasons for caution, too. The AViiON systems, based on the Motorola 88000 reduced instruction set computing (RISC) microprocessor, are themselves something of a risky proposition. Many of DG's RISC competitors are cashing in on the momentum associated with computers based on Sun's Scalable Processor Architecture chips or on microprocessers from Mips Computer Systems Inc.

DG's answer was, in part, a concerted 18-month effort to find software partners to support AViiON. More than 400 software vendors have ported close to 1,500 UNIX-based packages to AViiON. The number defuses, to some degree, objections that the Motorola engine is not standard enough.

In 1990, the company added to the low end of the AViiON line with machines that provide 17 million instructions per second of computing power for only $3,995. This March, the company pushed up the high end with the AV 7000 and 8000 systems, which deliver an attractive 117MIPS for $200,000. These systems are designed to lure customers who might move down to RISC-based servers from mainframes.

Organizationally, DG went through major changes last year. Most of the top 20 managers are new to the company. The restructuring also emphasized DG's entrepreneurial philosophy and deposited more accountability for profit and loss to the business units. And chairman of the board Edson D. de Castro, a DG founder and president until he handed over the reins to Skates in 1989, left the company on December 31.

Whether the Massachusetts company can buck the trend that has hit the state's ailing Route 128 technology zone remains to be seen. But improvements in product lines and cost control, coupled with new management, give Data General more hope than it's had in the last five years.—*Elaine L. Appleton*

NORTHERN TELECOM LTD.

3 ROBERT SPECK PARKWAY
MISSISSAUGA, ONTARIO, CANADA
L4Z 3C8
(416)-897-9000

RANK 25
IS REVENUE $1.22 B

The executives of Northern Telecom Ltd. want the company to become the world's leading supplier of telecommunications by the year 2000. In 1990, with total corporate revenue of $6.77 billion, analysts say, it was in sixth place. Its acquisition this year of Britain's telecommunications company STC PLC for $3 billion, will add nearly $2 billion to its annual revenue, lifting the company to third place. Northern Telecom says it now holds 6% of the world market for telecommunications equipment.

Although last year's revenues were up 11% from the $6.1 billion reported for 1989, they fell short of the 13% gain for the same period a year earlier, as both Canada and the United States were plagued by recession. Nevertheless, profits rose 22% to $460 million from $376 million in 1989. Northern Telecom's investment in research and development during the year dropped slightly as a percentage of revenues from 12% to 11.4% in 1989, but the dollar value rose by more than 6%, or $40 million: from $729.8 million in 1989 to $773.7 million in 1990.

During the year, Northern Telecom announced support of frame relay technology for its SuperNode central office switches. Frame relay has a key role in supporting bursty transmissions, such as LAN-to-LAN interconnection. Northern itself dropped out of the local area network business, terminating production of its Meridian LAN-Star line. The company only had 100 customers for the product.

The top 25 North American companies represent 81% of the total North American revenue.

Analysts believe Northern dropped LANs to concentrate on its FiberWorld family of fiber-optic transmission and switching products for the central office market, Northern Telecom's major business. The company announced FiberWorld in 1989 as a Synchronous Optical Network (Sonet), making Sonet available through the telephone companies' networks, while temporarily maintaining the existing copper-based network.

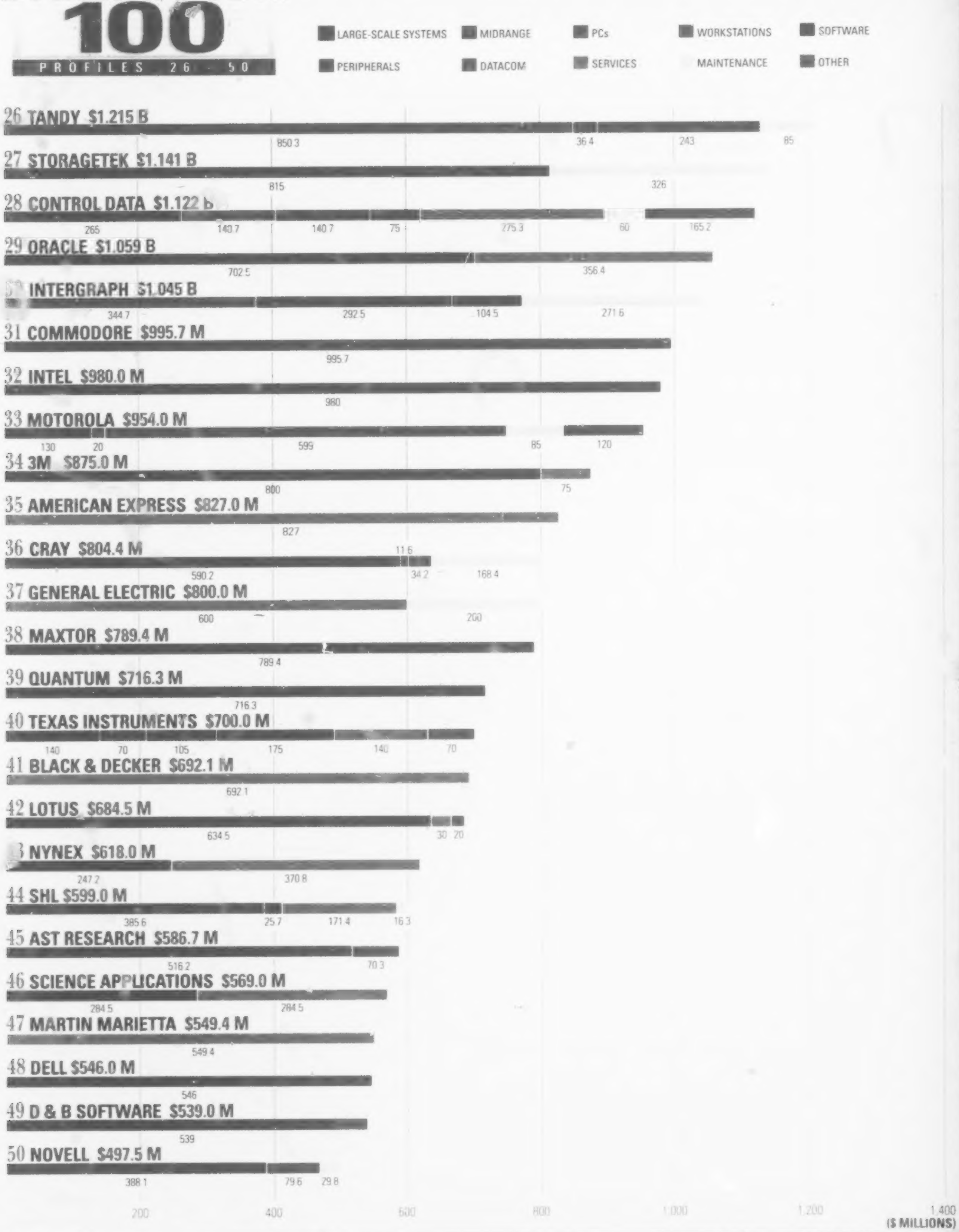
Early this year, the company reorganized its top management and consolidated major product lines. Among other changes, it divided its world trade organization into two operating units, one based in London and the other in Tokyo. It set up three product groups: Public Networks, which includes switching, transmission and cable operations; Private Networks, which includes private branch exchanges, key systems, data packet networks, terminals and other products for business customers; and Wireless Systems, which includes cellular systems.

In the reorganization, Northern Telecom named Edward E. Lucente, former head of IBM's Asia/Pacific operations, as the company's senior vice president for marketing. Lucente will be part of a four-member executive office in McLean, Va., headed by Paul Stern, chairman and chief executive officer of Northern Telecom.—*Tom McCusker*

THE DATAMATION 100

NORTH AMERICAN 100

PROFILES 26 - 50



TANDY CORP.

1800 ONE TANDY CENTER
FORTH WORTH, TX 76102
(817)-390-3700

RANK 26
IS REVENUE $1.21 B

For Tandy Corp., any year there's a recession can prove to be a difficult one. When consumers balk at spending money, Tandy's sales usually suffer, along with those of every other U.S. retailer.

Surprisingly, however, Tandy's overall revenues climbed 8% in 1990 to $4.65 billion. The portion of that revenue generated by information systems-related products amounted to $1.21 billion—almost a 24% jump from the $980 million in IS revenues garnered in 1989.

At the retail level, the company revamped the look of its Radio Shack stores and expanded its Name Brand Retail Group, which markets computers and other appliances under the name McDuff Electronics. Radio Shack shouldered much of the responsibility for meeting IBM's challenge in the home computer market—selling Tandy's 1000RL system against Big Blue's PS/1.

At the corporate level, Tandy's Grid Systems Corp. bore the weight of the company's efforts to sell systems to IS executives. In 1990, the Fremont, Calif.-based subsidiary faced challenges in defending its portable-computing turf against well-heeled competitors like Compaq Computer Corp. and Toshiba America Information Systems Inc.

Grid's weapons are formidable. The subsidiary last year introduced the 1450sx, a 7.9-pound, 80386SX-based laptop; the GRiD 1810, a notebook PC with a removable hard disk drive; and the GRiDCASE, a laptop with a built-in pointing device. It also maintained its lead in pen-based computing, a market expected by Dataquest Inc. to grow 10-fold between now and 1993, when unit shipments could approach 500,000 annually. The GRiDPad—a 4.5-pound keyboardless clipboard PC—practically owns the pen-based market, having caught on quickly with user organizations like utilities that have a large number of people working in the field. In January 1991, Grid also announced that it will support Go Corp.'s PenPoint, an operating system designed specifically for pen-based computing.

Grid has larger designs on the corporate IS market, as well. Last year, it introduced its first machine specifically aimed at the network server market—the Grid 486ei-25/SVR. And it's busy adding value-added resellers to complement its direct sales efforts.

—Bob Francis

STORAGE TECHNOLOGY CORP.

2270 SOUTH 88TH STREET
LOUISVILLE, CO 80028
(303)-673-5151

RANK 27
IS REVENUE $1.14 B

One of the clear beneficiaries of distributed computing and gutsy management is Storage Technology Corp. The huge number of personal computers, workstations and larger systems that were installed or networked in 1990 created gigabytes of information that many users chose to store centrally in tape cartridge libraries supplied by StorageTek. Demand for the company's 4400 Automated Cartridge System last year fueled revenues beyond $1 billion. And it funded much work on an important new storage product, code-named Iceberg.

The person who bet the Colorado ranch on the 4400 and Iceberg is chief executive officer Ryal R. Poppa. His conviction that greater storage requirements would be created by cheaper networked MIPS led the company in 1986 to focus on developing the library and to forego competition with IBM in another storage area, direct access storage devices (DASDs). The library can store data from as many as 14 different types of computer systems.

StorageTek's 1990 performance saved several of the chips Poppa had anteed up in his high-stakes storage game against IBM and Hitachi Data Systems Corp., the company's other big rival. StorageTek's revenue increased 16% from $983 million in 1989 to $1.14 billion in 1990 on the strength of the 4400 and related tape products, which together generated 71% of StorageTek's sales. The remainder came from two other product lines. Random access storage products, including two made by EMC Corp. that Storage Technology resells, made up 16% of revenue. Printers, a business now co-owned by Siemens-Nixdorf Informations-systeme AG, accounted for the remaining 11%.

In 1990, 30 companies topped the $1 billion mark, compared with 25 in 1989.

Earnings grew an impressive 45% to $69.3 million, year to year. It's 1991 and beyond, however, that will prove whether Poppa's new product instincts were right. Winning the storage game won't be easy. IBM is expected to introduce a rival library product this year. And IBM and Hitachi will be aggressively marketing their 3390-class storage devices—the DASD generation of disk technology that StorageTek chose to skip.

Late in 1991, the world may see the tip of the Iceberg, StorageTek's next-generation storage device built around disk array technology. In 1992, users may be able to buy it in volume. And Poppa predicts that, in 1993, Iceberg sales will eclipse or at least match library revenues.*—Tim Mead.*

CONTROL DATA CORP.

8100 34TH AVENUE SOUTH
BLOOMINGTON, MN 55425
(612)-853-8100

RANK 28
IS REVENUE $1.12 B

If the sentiments of Bob Kirkman, a senior consultant at Combustion Engineering Nuclear Power in Windsor, Conn., are any indication, Control Data Corp. may have turned the corner in its long struggle to restore customer confidence.

In 1989, CDC posted a $680 million loss. But last year the company eked out a $2.7 million profit on revenues of $1.7 billion—despite a fourth-quarter loss of $23.8 million created by one-time contract cost overruns and losses on the sale of certain businesses.

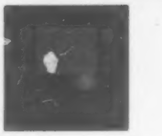
The ongoing turn around, says company management, has served to inspire new respect from users. Kirkman, the immediate past president of the CDC users group VIM, says, "It's been a tough haul, one requiring a very significant cultural change. But, personally, I think they have made the shift."

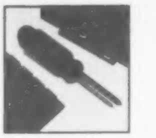
That shift has required a fundamental rethinking of the company's business and product line strategy.

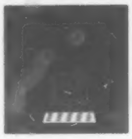
In Computer Products, CDC's strategy is to shift away from being a mainframe company to a standards-based systems integrator for the government and discrete manufacturing markets. CDC hopes to shift its Cyber mainframe customer base, which numbers 1,700 units worldwide, over to the six-model CDC 4000 UNIX system introduced in January of last year.

So far, the Computer Products group's effort—backed by five consecutive quarters of operating profitability—is meeting goals, says Lawrence Perlman, who became chief executive in January. "The 4000 did a little bit better than we had planned," he says. "But 1991 is a challenge for us, obviously. We must sell a couple of hundred units in 1991."

The Cyber line got its newest family member, the 2000, last year. CDC shipped one







machine in 1990, to the University of Western Ontario. The Cyber side of the business also landed a major contract last year with the Army Corps of Engineers. Valued at $365 million over 11 years, the contract calls for Cyber 960 computers, networking and systems integration services.

These and other gains have buoyed the company's future outlook, which Perlman has quantified by targeting earnings and earnings per share growth at 10% per year. CDC won't make that target in 1991, but Perlman clearly wants substantial progress in that direction.

"A year ago, we had a customer base that was confused," he says. "The greatest achievement we've made in the computer business—apart from being profitable—is that we've identified a strategic path for customers."—*David R. Brousell*

ORACLE CORP.

500 ORACLE PARKWAY
REDWOOD SHORES, CA 94065
(415)-506-7000

RANK
29
IS REVENUE
$1.06 B

Customers and investors alike were rudely shocked last year when they discovered that 13-year-old Oracle Corp. had grown up from the golden child of the software industry to become a fiscal juvenile delinquent.

Or so it seemed when, in the third quarter of 1990, the company disclosed a loss of $36 million on revenues of $204 million. The loss was apparently the result of some earlier creative accounting practices that booked some hopeful income as actual revenue—several large and never-paid-for orders. The company set about trying to mop things up by setting aside $42 million for unpaid customer bills, allocating $7 million against that quarter alone. Oracle's stock plummeted from a high of $26 to a low of $9 a share as a result. That added up to a paper loss of close to half a billion dollars for cofounder and chairman Lawrence Ellison, who owns about a quarter of the company's stock.

That kind of a loss can motivate a lot of change in a company, and Ellison responded quickly and aggressively. He laid off some 400 employees in a move to cut costs; knocked long-time chief financial officer Jeffrey Walker out of his job, putting him in a technical position; and bumped several top marketing managers into sales positions. Then he brought in Jeffrey Henly, a corporate finance pro, to be the new CFO. Henly set about trying to straighten out the books as quickly as possible with a team of outside auditors from Arthur Andersen & Co. SC, which was also charged with performing a management audit. As this story goes to press, in fact, word is that Oracle will be restating its 1990 and 1991 results once the audit is completed. As the restated numbers are not yet forthcoming, however, this year's DATAMATION 100 is using the original numbers.

And according to those numbers, at any rate, Ellison's action appears to be working; in the final quarter of last year, the company was able to turn that $36 million loss into a profit of $6.7 million. And, in this year's first quarter, the company reported a profit of $12.1 million. Still, Oracle is a long way from the kind of results it was showing just a year ago, when revenues increased by 95% and profits were running at close to $100 million.

Despite all the turmoil surrounding the company's financial status, Oracle is still moving ahead forcefully with a wide array of new and enhanced products. The company has announced a series of Windows and desktop-oriented products—including a HyperCard-like applications development platform, MS-DOS and OS/2 versions of Oracle Tools and an OSF/Motif version of the SQL*Forms and SQL*Menu report generators. The company has also started to ship its Oracle 6.2 relational database management system, which has parallel-processing capabilities, for VAX clusters.

—*J. William Semich*

INTERGRAPH CORP.

ROUTE 20
HUNTSVILLE, AL 35894
(205)-730-2000

RANK
30
IS REVENUE
$1.04 B

Intergraph Corp. enjoys a rare competitive advantage—location. Distanced from the distractions of Silicon Valley or Route 128, where computer companies that make their own microprocessors are scorned and where market share is everything, Intergraph has transformed itself rapidly from just another workstation maker to a sharply focused supplier of workstation-based mapping, technical information and electronics design systems.

The focus on applications raised Intergraph's revenue's in 1990—as well as its expenses. Revenues expanded 21% to $1.04 billion, with fully 53% of sales and service dollars generated overseas. But earnings last year fell 21% to $62.6 billion. The biggest culprit in the expense category was the sales and marketing outlay, which jumped 33% to $209 million in 1990. Research and development investments, which grew 20% to $110 million during the year, also factored in Intergraph's higher cost structure.

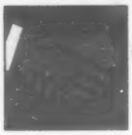
Much of the R&D effort focused on Intergraph's 2000 line of low-end UNIX workstations and servers, which debuted in September. The 2000 products, starting at $15,900 for 12.5 million instructions per second of reduced instruction set computing (RISC) performance, complemented the 6000 line of midrange and high-end UNIX/RISC systems, which Intergraph had unveiled earlier in the year.

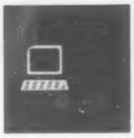
In the estimates of Dataquest Inc., Intergraph lost ground on the workstation battlefront in 1990. The San Jose-based market research firm figures that Intergraph's share of worldwide workstation sales slipped from 7% in 1989 to 6.8% in 1990. IBM, Silicon Graphics Computer Systems Inc. and Sun Microsystems Inc. meanwhile widened their turfs.

But, in the eyes of Intergraph president Eliott James, these figures are nearly meaningless. The 2000 and 6000 products, he believes, provide the company with a price/performance platform on which to build applications for its core markets—technical information management (which embraces computer-aided design systems), geographic mapping and electronics design. Major customer wins in these markets include the Union Pacific Railroad Co., which is digitizing and storing all of its information about routes and tracks onto Intergraph systems; and the American Information Technologies Corp., which is mapping information on 12 million customers onto Intergraph systems.

One engineering-intensive market where Intergraph's presence will be increasingly felt in 1991 is electronics. Earlier this year, the company purchased Daisy/Cadnetix Inc., the former Daisy Systems Corp. electronics design automation house, for $14 million and renamed it Dazix-Intergraph Inc.

With the Dazix acquisition, Intergraph also inherited another platform to support—Sun workstations, on which Dazix's software runs. But Intergraph's decision, subsequent to the Dazix acquisition, to buy $150 million worth of Sun equipment and resell it with Dazix software during the next three years doesn't bother securities analysts, who normally worry when a computer company tries to support multiple hardware architectures and operating systems. Analysts are encouraged by the rising importance of Intergraph's MicroStation software products, which run on Macintosh, MS-DOS and Sun platforms, as well as of the widening suite of electronics automation software that runs on Sun's systems.





Such moves shouldn't be interpreted as a sign that Intergraph is going to exit the hardware business, however. The alternative isn't appealing. "It's difficult to sustain a large software company," James says, observing that there are only four or five software companies that pull in more than $500 million in annual revenues.—*Tim Mead*

COMMODORE INTERNATIONAL LTD.

1200 WILSON DRIVE
WEST CHESTER, PA 19380
(215)-431-9100

RANK 31
IS REVENUE $995.7 M

Commodore International Ltd.'s five years of preaching the benefits of its Amiga line finally began to pay off last year. As the world tuned in to the futuristic multimedia messages of competitors Apple Computer Inc., IBM and Microsoft Corp., a shortage of affordable, easy-to-use products from those firms forced many multimedia enthusiasts to look elsewhere.

As a result, an increasing number of people bought Commodore's Amiga, a system even critics contend is well suited for graphics and sound processing, the basic ingredients for multimedia. Amiga sales exceeded 50% of corporate revenue for the first time in 1990, and Commodore finished the year with overall revenues up 15% from those of 1989.

Most of Commodore's success didn't become evident until the second half of the year. After stumbling through a number of management changes and disappointing sales of its MS-DOS based PCs, the company hit its stride. New Amiga systems at both the high and low ends of the family helped Commodore sell computers into a broader base of business, education and consumer markets. The company also reengineered its MS-DOS systems and introduced a more competitive family of PCs and laptops based on Intel 80386 and 80486 microprocessors.

The Amiga's strong multimedia reputation got a favorable boost early in the year from a small third-party equipment supplier. Newtek Inc. introduced an inexpensive expansion board and software that can turn the Amiga into a sophisticated post-production tool. The equipment can process video signals from a number of different sources, including television, videocassette recorders and video cameras, rivaling dedicated machines that sell for $50,000 and more.

Commodore sold more personal computers in Europe than any other company except IBM last year. But Commodore's traditional strength in Europe was offset by relatively weak sales in North American and Asian markets. Many analysts say that Commodore's biggest challenge this year will be to jump start its North American operation, which in 1990 brought in just 18% of companywide revenues. "The old news is that we haven't really succeeded in recovering in the U.S. to the extent we want," says Ron Alexander, Commodore's chief financial officer. "The good news is that we are a billion dollars in sales, and when the U.S. [market] does pick up, we should have real upside potential."

For 1991 and beyond, Commodore is counting on increased consumer interest to return it to the leadership position it enjoyed in the early 1980s. A new product introduced early this year called the CDTV Player may hold the most promise. Based on Amiga technology, the CDTV Player includes a compact disc player for both video and audio material and sells for under $1,000. Similar in concept to the still-unreleased CD-I systems from NV Philips GL and Sony Corp., Commodore's offering is available now and building up a software base. Says CFO Alexander: "I think we should be very well positioned for Christmas."—*Paul Pinella*

PC revenue from the top 100 North American companies grew more than 12% in 1990.

INTEL CORP.

3065 BOWERS AVENUE
SANTA CLARA, CA 95051
(408)-765-8080

RANK 32
IS REVENUE $980.0 M

Intel Corp.'s 80386 and 80486 flagship chips powered the company to a record year, despite competition from various high-powered reduced instruction set computing (RISC) chips. With sales booming, Intel pumped ever-increasing amounts of money into both research and development and new plant construction. R&D expenditures rose to $517 million in 1990, or 13.2% of revenue. Capital additions climbed 61% from $422 million in 1988 to $680 million in 1990 and are projected to exceed $800 million this year.

Last year, the company targeted the hot marketplace for portable computers as a key growth area. Intel introduced the 386 SL microprocessor and a companion input/output chip for use in laptop PCs. It also brought to market 1-megabyte and 4MB memory cards based on its nonvolatile flash memory technology.

At the other end of the computing spectrum, Intel's Supercomputer Systems Division has become a major player in the rarefied world of massively parallel supercomputers. Along with its commercial iPSC/[illegible]60 machine, which can incorporate up to 128 of Intel's i860 RISC processors, Intel has been developing an advanced parallel machine as part of a project called Touchstone.

That project's goal, which should be attained late this year, is to demonstrate a prototype containing more than 2,000 processors and operating at more than 100 billion floating point operations per second (GFLOPS). Called the SIGMA, the prototype will make use of a successor chip to the i860, scheduled to be introduced sometime this month.

Happiness over record financial results at Intel in 1990 was tempered by the loss of cofounder and vice chairman Robert Noyce, who died on June 3, 1990. Noyce is credited as a coinventor of the integrated circuit. —*Dwight B. Davis*

MOTOROLA INC.

MOTOROLA CENTER
1303 EAST ALGONQUIN ROAD
SCHAUMBURG, IL 60196
(708)-397-5000

RANK 33
IS REVENUE $954.0 M

For years, computers were an unprofitable sideline for Motorola Inc., which enjoyed far more success making computer chips, cellular telephones and other communications products. However, over the past year, Motorola has energized its commitment to computers by unleashing a new workstation line and an enhanced version of its existing Delta midrange series.

The new Motorola systems, which use the new and much delayed Motorola 88000 reduced instruction set computing (RISC) microprocessor, have won high marks for their power and price/performance.

Unfortunately for Motorola, the firm's

overall computer sales are still short of expectations. According to Tom Beaver, general manager and vice president of the Motorola Computer Group, computer sales rose only 14.5% last year, primarily because of problems in Europe. According to Beaver, some poor pricing decisions and the lack of a multilanguage program for the firm's MultiPersonal computer stymied sales in Europe, which bring in more than a third of Motorola's revenues. DATAMATION estimates sales of the Motorola Computer Group at $355 million, including revenues from service and sales of single-board computers employing the virtual machine environment (VME) bus. Motorola is the leading supplier of VME boards, which represent about a third of the total Computer Group sales.

But 1990 did have its bright spots for the Computer Group. Motorola beat out Digital Equipment Corp. and IBM to be awarded a five-year $55 million dollar contract by the state of Tennessee for its Delta 3000 computers. And systems integrator General Automation Inc. agreed to buy more than $36 million of the Delta 3000- and 8000-series computers over the coming years.

Motorola's overall IS business, which consists of the Computer Group and the Codex Corp. and UDS/Motorola data communications subsidiaries, accounted for $954 million in sales in 1990, up 11% from 1989. Overall, sales rose 13% for Motorola, while net earnings were essentially flat at just under $500 million.

Codex has been struggling to make the transition from analog to digital technology and position itself as a supplier of networking systems. The subsidiary is plowing some $80 million a year into research and development, about 16% of its revenues, which is part of the reason it posted an operating loss of $1 million in 1990. Important new products introduced by Codex included release 3 of the Codex 9800 Series Network Management System. Sales and orders at UDS/Motorola rose primarily on the strength of the subsidiary's line of V.32 modems, which run at 9,600 bits per second.

Motorola also has decided to tackle the market for local area networks with a new type of wireless in-building network. The new Motorola network, which was announced in November, is said to be able to transmit at the full Ethernet rate of 10 megabits per second. Motorola says it is heavily committed to the wireless data communications market and intends to release a whole family of products over the coming decade.—*Joe Kelly*

MINNESOTA MINING AND MANUFACTURING CO.

3M CENTER
ST. PAUL, MN 55144
(612)-733-1110

RANK 34
IS REVENUE $875.0 M

No one will ever call data backups exciting, but provide a way to make them easy, and the public will beat a path to your door.

That was the logic behind Minnesota Mining and Manufacturing Co.'s decision to pioneer the backup data cartridge, and it has no reason to be sorry.

Data cartridges helped fuel $800 million in sales of magnetic media products for 3M in 1990, according to the Santa Clara Consulting Group, which follows the magnetic media market.

In addition to data cartridges, 3M also markets data diskettes for PCs, ½-inch reel tape and 3480 cartridges. 3M's worldwide sales of media products grew nearly 20% over 1989, according to David Bunzel of the Santa Clara Group.

The demand for backup tape cartridges is expected to grow significantly in the 1990s, spurred by the growing popularity of server-based networks. The theory is that once data backup for PCs becomes the responsibility of someone other than the PC user—e.g., the network manager—interest in backup devices will soar.

Mainframe revenue from the top 100 North American companies dipped 10.1% in 1990.

At COMDEX Fall in Las Vegas last year, 3M was one of several vendors to demonstrate a 1.35-gigabyte data cartridge and drive system, the first in a series of gigabyte-class products and a substantial increase over the 525-megabyte models previously available. By introducing these gigabyte-class cartridges, 3M and the other vendors—which include Archive Corp., Sankyo Seiki America Inc. and Tandberg Data Inc.—hope to forestall market inroads from digital audio tape products.

3M reached into the 3480 backup market in a big way in 1989 when it bought IBM's Tucson, Ariz., plant for manufacturing data cartridges. 3M also competes successfully in the diskette market by emphasizing sales of its own 3M brand diskettes. In 1990, Bunzel says, 3M decreased its sales of unbranded diskettes.

In addition, 3M is involved in developing document-imaging systems, but that is still a fledgling venture. Beyond magnetic media, 3M's other major IS activity is providing information systems for the health care market through products such as Code 3, Health Evaluation and MedLab. DATAMATION estimates the health group's sales at about $75 million.—*Joe Kelly*

AMERICAN EXPRESS CO.

AMERICAN EXPRESS TOWER
WORLD FINANCIAL CENTER
NEW YORK, NY 10285
(212)-640-2000

RANK 35
IS REVENUE $827.0 M

In the 1980s, American Express Co. transformed itself from a travel services company into the prototype for today's financial services conglomerates. One by one it acquired brokerage houses, investment banks, international banks and insurance companies. Along the way, American Express also quietly bought up companies in the IS business.

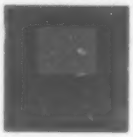
Today, IS is the bright spot on the company's otherwise checkered income statement. Earnings from the various operations that make up the American Express Information Services Corp. (ISC) were $105 million, accounting for more than half of American Express's total earnings of $181 million last year. Meanwhile, revenues from information services rose 25% to a healthy $827 million—but still just 3.4% of American Express's total revenues of $24.3 billion.

Overall, American Express had a tough year, as earnings fell way below the $1.1 billion level set in 1989. The big killer was American Express's Shearson Lehman Brothers brokerage and investment banking operations, which lost $956 million.

In January 1991, ISC took over the back-office processing operations of Shearson Lehman, establishing it as the Securities Information Group.

According to the ISC's newly appointed chief information officer, Richard F. Morrison, American Express is committed to leveraging its name in order to play a major role in outsourcing. Morrison says ISC is interested in pursuing outsourcing arrangements that go beyond banks and Wall Street.

American Express first got into IS in 1980, when it bought First Data Resources, the



world's largest processor of debit and credit card transactions. Over the years, it has acquired companies that provide processing services for a variety of industries, including health services and cable television. In addition, ISC has a proven track record in providing processing services to the financial community through its Shareholder Services Group.

In 1989, American Express grouped all of its IS businesses together into the higher profile ISC organization and made it one of the company's five operating-units. In 1990, American Express included a commitment to IS in its mission statement. Altogether, ISC employs more than 16,000 people.

Morrison says he expects the addition of the Shearson business to propel ISC beyond $1 billion in revenues this year. Also helping to fuel this growth will be ISC's acquisition of London-based Signet Ltd., the largest credit card processing operation in Europe.—*Joe Kelly*

CRAY RESEARCH INC.

655A LONE OAK DRIVE
EAGAN, MN 55121
(612)-683-7100

RANK
36
IS REVENUE
$804.4 M

Cray supercomputers can model everything from global weather patterns to fighter jet aerodynamics, but the machines might short circuit if they were required to analyze the operations of their parent company.

Cray Research Inc.'s financial performance isn't the circuit breaker; it's the company's future product strategy that's challenging to analyze. Profits rose 27% to $113 million, despite the fact that revenue expanded only 2.5% to $804 million. What bears attention are two major shifts in the company's product strategy. For the first time, Cray began to address the less glamorous minisupercomputer market in the form of the Cray XMS line. And, for the future, the company announced its intention to build massively parallel systems.

The XMS superminis represent a reworking of technology developed by Supertek Computers Inc., which Cray Research acquired early in 1990. Starting at about $240,000, the XMS machines run UNICOS, Cray's flavor of the UNIX operating system. The machines also are compatible with Cray's installed base of X-MP supercomputers.

This year, Cray Research introduced the YMS line of minisupercomputers, priced from about $250,000 to $1 million and compatible with the 20 Y-MP models that make up the company's current suite of supercomputer offerings. Of its Y-MP models, six belong to the Y-MP2E class of entry level supercomputers, also introduced last year. Priced at $2.2 million and up, the Cray Y-MP2E machines are the first of Cray's supercomputers to use air, rather than liquid, cooling.

But if 1990 is remembered for anything at Cray, it will be as the year in which the company shifted from skeptic to convert on the subject of massively parallel processing (MPP). Last fall, Cray chairman John A. Rollwagen announced that the company would begin its own MPP project; a prototype machine is expected in 1992 or 1993.

Cray has by no means given up on its current architecture, which embodies at most a few powerful processors working in tandem. In its eyes, the Y-MP machines will not be superseded by future MPP supercomputers. "Massively parallel processing can, for some specialized applications, enhance general-purpose computing," Rollwagen says.

The MPP initiative and the expansion of Cray's products at the low end (minisupers) and high end (Y-MP/16) are part of an overall strategy aimed at expanding the company's revenues in the future. Other components of Cray's game plan include selling deeper into existing accounts, increasing customer satisfaction and widening the company's base of applications software. If Cray achieves its objective of 10% growth in sales in 1991, an analysis of the company will have to conclude that it's much more than a one-product-line company.—*Dwight Davis*

GENERAL ELECTRIC CO.

3135 EASTON TURNPIKE
FAIRFIELD, CT 06431
(203)-373-2211

RANK
37
IS REVENUE
$800.0 M

General Electric Information Services (GEIS), the Rockville, Md., computer services arm of parent General Electric Co., operates an impressive worldwide teleprocessing network that handles some 400,000 user sessions each day and transmits some 300 million characters of data in and out of the system every hour.

As it did the year before, GEIS added 2,000 clients to its electronic data interchange business in 1990, for a total of 8,600 customers. The company also announced new services and applications based on EDI, which has become a foundation business for GEIS. One introduction was the EDI/EFT Translator software, which provides banks with reconciliation services for corporate clients. The company also brought out a new version of its EDI*PC software (version 7.0), which simulates a user's desktop through the use of icons, thus providing more efficient management of information flow.

Another product, called Customer Originated Electronic Payments (COEP), was added to the company's EDI services, permitting the electronic collection of receivables.

"We see major areas of our business where we're on the fourth or fifth document types in the trading community," says Paul Zoukis, GEIS's vice president of marketing.

GEIS's major EDI customers are in the retail industry. Last year, GEIS launched a plan to help the Dallas-based retailer J.C. Penney Co. use its QUICK/Response Program to increase the number of suppliers linked to the J.C. Penney headquarters from 300 to 5,000.

The top 50 North American companies constitute almost 92% of the total North American revenue, the same as in 1989.

In answer to complaints that it had outgrown its ability to service customers, GEIS completed a streamlining of its EDI customer services operation last year. Reports of telephone calls unanswered for hours, and sometimes days, were curtailed by implementing stringent quality control measures and doubling the customer service staff to 50 people, says Robert A. Simmons, manager for EDI marketing. As part of the streamlining, GEIS opened its EDI customer service center in November.

In March, GEIS inaugurated CARGO*LINK, a network-based product for international trade and transportation. The service offers EDI for shipment data, database access for transportation business information, consignment tracking and electronic mail. Last year GEIS also introduced an international hotel reservation package called Manor, whose applications ultimately can be used in EDI networks.

The company began taking advantage of the political changes in Eastern Europe last year, first setting up a network node in what was East Berlin, then nodes in the former East German cities of Dresden, Chemnitz and

Leipzig. These activities soon wound down as GEIS clients' interests in reaching Eastern Europe waned in the face of political complexities. "We decided there's no quantum move we wanted to make until our clients are willing to extensively conduct their business in those areas," says Zoukis. —*Tom McCusker*

MAXTOR CORP.

211 RIVER OAKS PARKWAY
SAN JOSE, CA 95134
(408)-432-1700

RANK
38
IS REVENUE
$789.4 M

After more than eight years of solid earnings and steady management, Maxtor Corp. had some rough sledding last year. Despite raking in record revenues of $789.4 million in 1990, Maxtor had a $3.9 million loss in the last quarter of the year. President and chief information officer George M. Scalise, along with several high-level managers, departed shortly afterwards. James M. McCoy, a founder of Maxtor and board chairman since 1986, was named to replace Scalise as president and CEO. In May, Scalise was succeeded by Laurence R. Hootnick. And at the beginning of 1991 the company axed 140 workers.

Even though total corporate revenues grew almost 77% in 1990, net earnings tumbled 22% to $10.8 million. Most of that drop stemmed from the fourth-quarter loss, which Maxtor attributes to intense competition in the 3½ inch, 40-megabyte disk drive market and high costs associated with the acquisition of most of the assets of MiniScribe Corp., which was then operating under Chapter 11 bankruptcy protection.

Maxtor is a major player in the 5¼ inch drive market. In 1990, the company started shipping a gigabyte+ 5¼-inch drive. And Maxtor leads the market in sales of 5¼-inch 760MB and 380MB hard drives to original equipment manufacturers (OEMs), according to International Data Corp., the Framingham, Mass., research firm. But several big drive makers, including Micropolis Corp. and Seagate Technology are right behind it and closing fast.

Maxtor says the move to acquire MiniScribe is part of Maxtor's plan to augment its 5¼-inch technology with newer 3½-inch drives, in particular the 1-inch high, 3½-inch variety. With that in mind, the company recently turned to Japanese industrial giant Kubota Corp., its partner in an optical storage joint venture called Maxoptix, for fresh infusions of cash to help buoy the transition and to go after the growing optical storage market.

Maxtor continued to move its manufacturing operations overseas in 1990. The company's three divisions, which along with Maxoptix include Disk Drive Operations and Storage Dimensions Inc., manufacture hard drives and drive assemblies in several Pacific Rim countries, as well as in Bray, Ireland. The company says it will concentrate most of its manufacturing operations in Europe and Asia in the future, since it sells more than 40% of its products to OEMs there.—*Mike Ricciuti*

QUANTUM CORP.

1804 MCCARTHY BOULEVARD
MILPITAS, CA 95035
(408)-432-1100

RANK
39
IS REVENUE
$716.3 M

Quantum Corp. demonstrated its ability in 1990 as a surefooted player in a slippery market. When sales of 3½-inch hard drives slowed in the first quarter of 1990, it began making 2½-inch, 42- and 84-megabyte drives for laptop builders.

The result was a bonanza. Revenues reached $716.3 million, a whopping 82% gain over those of the previous year. Due mainly to the lowest operating costs in the disk drive industry, analysts say, total operating profit rose an impressive 65% to $93.7 million, and net earnings rose a correspondingly substantial 62% to $66.7 million.

The company introduced 10 new products in 1990, including additions to its ProDrive 3½-inch and GoDrive 2½-inch drive lines. Two new Hardcard drives were introduced by Quantum's Plus Development Corp. subsidiary. These drives install in expansion slots and offer 52MB and 105MB of storage to PC users.

One reason for the 11-year-old company's continued success lies in its growing customer list. In 1988, Quantum had four original equipment manufacturer customers, of which Apple Computer Inc. was, and still is, the largest. But the list has now swelled to 30, with the addition of AT&T, Hewlett-Packard Co., Intel Corp., NCR Corp., Next Inc., Sun Microsystems Inc., Unisys Corp. and Zenith Data Systems. The company also added European customers, including London-based Apricot Computers PLC; Brother International Europe Ltd., the European subsidiary of the Japanese firm; and the Swedish firm Victor. European sales make up 27% of Quantum's total revenues.

In October of 1990, Apple gave Quantum one of its biggest OEM contracts to date. The computer maker included Quantum's new 1-inch high, 3½-inch, Small Computer System Interface (SCSI) drives into new Macintosh models. The 40MB and 80MB drives are installed in Macintosh Classic, LC and IIsi models.

In 1991, Quantum will try to push even further into the laptop and notebook PC markets, according to chairman and chief executive officer Stephen M. Berkley. And analysts say that Quantum, with its low manufacturing costs and no debt to service, should fare well against competitors such as Conner Peripherals Inc. and Maxtor Corp.

—*Mike Ricciuti*

TEXAS INSTRUMENTS INC.

13500 NORTH CENTRAL EXPRESSWAY
DALLAS, TX 75243
(214)-995-2011

RANK
40
IS REVENUE
$700.0 M

On the surface, Texas Instruments Inc. defied corporate logic in 1990.

While most IS suppliers narrowed their product and services offerings during the year, TI continued to expand its focus on a variety of new systems and software. Notebook PCs, software engineering tools, printers, UNIX-based multiuser systems, industrial automation software and custom hardware manufacturing constituted the external products and services that TI tailored for information systems managers last year, ringing up IS revenues of $700 million, by DATAMATION's estimates.

Beneath it all lies a strategy built on TI's own vision of enterprise computing. As part of this strategy, the company's 9,000 external IS product and marketing workers are managed by the same man who commands the 1,000-person internal IS operation. John White, general manager of TI's Information Technology Group (ITG), runs his company's sprawling IS enterprise as well as overseeing TI's five IS product and service divisions.

White's dual command gives TI an advantage, although it didn't show up on the company's bottom line in 1990. White's group lost money last year, as did TI as a whole—a $39 million loss for the company in 1990 on flat revenues of $6.6 billion.

TI's edge, it seems, is its ability to spin off commercial products from the $300 million the company spends annually on its own IS operations. Software engineering is the most visible beneficiary. The company's Advanced Information Management Division, the smallest of ITG's five external businesses, markets a leading-edge computer-aided software engineering product known as the Information Engineering Facility.

TI also uses its extensive experience in manufacturing operations to develop products for the Industrial Automation Division, known for its UNIX-based TIStar programmable controller systems and its VAX-based distributed control systems. The division generates about 20% of the IT group's revenues.

The biggest ITG member is the Peripherals Products Division, home of the company's successful MicroLaser line of desktop laser printers and Travelmate 2000/3000 line of portable computers. "We want to be a significant player in notebook technology," White states.

TI's Computer Systems Division specializes in making UNIX-based multiuser systems for users in the health-care, real estate, telecommunications and automotive industries. Like most systems companies with products designed around Motorola Inc.'s 68040 chip, TI's plans for using the 32-bit microprocessor were postponed because of delays at Motorola's end. Just the same, White claims TI expanded sales of its model 1500 UNIX multiuser systems (based on the 16-bit 68020 chip) by 70% in 1990. "And we're projecting significant growth in 1991—in part because we'll be delivering our first 68040 products," he says. More important, the ITG chief figures he can make money this year.—*Tim Mead*

THE BLACK & DECKER CORP.

701 EAST JOPPA ROAD
TOWSON, MD 21204
(301)-583-3900

RANK 41
IS REVENUE $692.1 M

Last year, DATAMATION predicted it would be the first and final year Black & Decker Corp. would make the DATAMATION 100 list. The company was clearly interested in divesting the Information and Electronic Systems (IES) business it had acquired with the purchase of Emhart Corp. in 1989.

IES—composed of Advanced Technology Inc. and Planning Research Corp.—was on the block until April 1990. No one anteed up what Black & Decker was asking, so the firm decided to keep them.

"During the time Black & Decker was looking to sell its computer division, things were happening in the world that did not appear good for our computer business, which specializes in government contracts," a B&D spokesperson explains. "With the fall of the Berlin Wall and the changing political climate in Eastern Europe, the Department of Defense did not look appealing." But the Gulf War has changed that.

The latter half of 1990 was spent reorganizing and integrating the two companies into a new subsidiary, PRC Inc., which was formally established on January 1, 1991.

PRC's largest contract awards in 1990 were a $76 million contract for information resources management awarded by the General Services Administration's Office of Technical Assistance and a $65 million award from the U.S. Senate for systems integration of local and wide area telecommunications networks.

PRC also was busy providing systems and services to support the Gulf War. The company hopes to continue its presence in the Gulf, both supplying the military and participating in commercial opportunities that arise from rebuilding Kuwait. PRC has been recommended by Virginia's Department of Economic Development to help in the initial cleanup efforts.

Approximately 65% of PRC's total business is in the government sector (30% with DOD), but one of the major goals of the newly merged subsidiary is to increase its commercial business to reach a 50/50 balance with government.

Although it escaped sale in 1990, PRC's future with Black & Decker is not carved in stone. Black & Decker will own PRC "indefinitely," says the spokesperson, "but it will depend. It is doing well, and the potential to do better is so great."—*Sarah Lindsey*

LOTUS DEVELOPMENT CORP.

55 CAMBRIDGE PARKWAY
CAMBRIDGE, MA 02142
617-577-8500

RANK 42
IS REVENUE $684.5 M

"The Times, They Are A Changin'" might very well have been the theme song of Lotus Development Corp. in 1990.

Despite new threats from competitors and a slowness to embrace Windows, Lotus is still entrenched as the second largest microcomputer software supplier, behind Microsoft Corp. Lotus, which once seemed ready to bet the farm on OS/2, has done a complete about-face in the past 12 months. Plans for its OS/2 product have fallen by the wayside in the company's belated rush to catch up with Windows mania. Now in the works is 1-2-3/W, a Windows version of Lotus's long-lived 1-2-3 spreadsheet.

The software manufacturer is also at work on a Windows version of its Freelance Graphics presentation graphics program. And earlier this year, the company delivered a major upgrade to Lotus Notes, its Windows-based groupware application. Finally, last November's acquisition of Atlanta-based Samna Corp. has put Lotus in the Windows word-processing market with Samna's two established programs, Amí and Amí Professional.

"From our point of view, we made a substantial investment in OS/2," says Frank King, vice president of Lotus's software business group. "But I think it OS/2 will mean very little now. We will try to keep up with OS/2 in a modest way," says King, but he acknowledges that, for the moment, Windows has far outdistanced OS/2.

Lotus's fastest growing markets are outside the United States, a trend the firm is striving to change. On the product side, it hopes to boost domestic sales with 1-2-3/W and 1-2-3 For The Mac, which are both pegged for release this summer. In the last 18 months, the software maker has delivered versions of its spreadsheet on a plethora of hardware platforms, including mainframes, minis, workstations and PCs. Overall, Lotus saw revenue grow by 23% in 1990 to $684.5 billion and hopes to match that growth in 1991.

—*John McMullen*

NYNEX CORP.

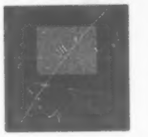
1113 WESTCHESTER AVENUE
WHITE PLAINS, NY 10604
(914)-644-6000

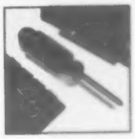
RANK 43
IS REVENUE $618.0 M

In 1990, NYNEX began reshaping its information services businesses by streamlining its organizational structure and focusing more on vertical markets. Over the summer, NYNEX disbanded its Complex Systems Integration Group, which had been used to bring together outside vendors and various NYNEX companies to handle large projects. The company now directs such projects individually—and, it says, more efficiently—from each of NYNEX's eight business units. Meanwhile, Telco Research Corp.—an integrated software and services group—was sold in November.

Three of NYNEX's business units are mainly providers of software, professional services and facilities management: AGS Computers Inc., The BIS Group Ltd. and NYNEX Computer Services. One is a national reseller—NYNEX Business Information Systems Co. The other four, such as New England Telephone, are primarily concerned with telephone service.

NYNEX's desire to focus on vertical markets is understandable, considering its success in the banking and financial industries. About 35% of the company's IS business is in those markets, says A. Theodore Engkvist,





currently president of AGS Computers. During 1990, Engkvist was president of NYNEX's Information Solutions Group, which this year was replaced by NYNEX Worldwide Services.

Strength in banking was a major factor in NYNEX's almost 25% growth of IS revenues last year. Other vertical industries doing well for the company are discrete manufacturing, communications, utilities and government. Engkvist says that NYNEX booked enough consulting and other services in 1990 to put the company among the top eight providers of such services.

Acquisitions also helped boost NYNEX's IS business last year. The company bought Stockholder Systems Inc. in September for $70 million.—*Mark Schlack*

SHL SYSTEMHOUSE INC.

SUITE 501
50 O'CONNOR STREET
OTTAWA, ONTARIO, CANADA K1P 6L2
(613)-236-1428

RANK 44
IS REVENUE $599.0 M

SHL Systemhouse Inc., Canada's leading systems integrator and computer services provider, has grown dramatically over the last two years through acquisitions. In 1990, however, the financial troubles of Systemhouse's parent company, Kinburn Technology Corp., put the company's future in jeopardy.

Kinburn, a management holding company, borrowed heavily in the 1980s to finance its various investments, which in addition to Systemhouse included Xios Systems Inc., an office automation company, and seven paper companies. But Xios couldn't compete with PC-based systems, and in 1990 the bottom fell out of the paper pulp industry, leaving Kinburn unable to meet its debt payments. After an unsuccessful effort to sell Systemhouse and raise cash, Kinburn's creditors stepped in and seized its assets. Systemhouse is now 56% owned by a group of Canadian banks and BCE Inc., with the rest in public shares.

The turmoil surrounding Systemhouse's owners scared customers away. New orders booked in one quarter last year fell as low as $4 million—down from a quarterly average of about $50 million. For the entire year, Systemhouse lost C$41.5 million ($35 million) on revenues of just under C$700 million ($599 million), including a C$35.6 million write-down during the year of goodwill and accounts owed by companies connected to Kinburn.

Systemhouse has been downsizing its unprofitable Washington, D.C., office, which accounts for about 15% of total revenues. But it was a big contract won in Washington that helped Systemhouse get back on track in a big way at the beginning of 1991. Systemhouse won an 11-year, $270 million contract to provide the U.S. Postal Service with the systems and services it needs to support its overnight express mail service. Systemhouse will provide the centralized database for the system out of its Houston data center, one of three that Systemhouse operates.

Systemhouse president Peter Sandiford points to the post office contract as an example of how Systemhouse is moving from being provider only of contract system development services to a more general purveyor of processing and management services. "We saw other people getting a lot of customer dollars after we put a strategic system in place," says Sandiford. "We are getting into outsourcing not from the point of view of being cost-cutting experts but from the point of view of providing a leading-edge service."—*Joe Kelly*

AST RESEARCH INC.

16215 ALTON PARKWAY
IRVINE, CA 92713
(714)-727-4141

RANK 45
IS REVENUE $586.5 M

For AST Research, 1990 was the year to break through the $500 million revenue mark, throw off the clone image and take its place alongside other industry leaders. The firm defied critics who said this 10-year-old PC supplier would be squeezed from the high end by Compaq Computer Corp. and IBM and pressured by the low-cost bottom feeders who sell by mail.

AST proved them wrong by sticking to its two-tiered product strategy, laid down two years ago when it split its systems products into two families: the Premium and Bravo lines. The Premium family consists of high-end systems competitive with Compaq and IBM; the economically priced Bravo family competes against lower cost systems from the likes of Dell Computer Corp. and Northgate Computer Systems.

Both Premium and Bravo did well last year, with 386-based systems capturing $270 million in fiscal 1990 revenue alone. Last year, AST's 486 business accounted for 11% of overall sales. Sales of 80486-based systems are expected to increase at a faster pace this year, as customers of existing Premium systems take advantage of AST's Cupid-32 architecture and migrate to a 486 machine via a simple board swap.

AST also benefited from keeping manufacturing costs under control and delivering high-performance systems to its original equipment manufacturer (OEM) and value-added reseller (VAR) dealer channels faster than the competition. Over half of AST's 1990 revenues were linked either to VAR or OEM contracts with such companies as Tandem Computers Inc. and Texas Instruments Inc.

Despite spending only $18.4 million in research and development during fiscal 1990, which ended in June—an amount critics charge may not be enough in today's competitive market—AST introduced an impressive roster of new products last year. In October, the company began shipping its DualStation 386SX/16 to Japan and became the first U.S. manufacturer to offer a machine that meets both the MS-DOS and NEC 9001 computing standards. The Premium Exec family of notebook computers, manufactured in AST's Fountain Valley, Calif., plant, made its debut in November. The aggressively priced notebooks were hailed at COMDEX for their high performance and ability to upgrade the processor—an industry first.

Further proof of AST's rise to industry prominence is its international activity. Revenue from overseas sales accounted for 36% of the company's fiscal 1990 revenue, up from 29% in 1989.

As for 1991, AST will launch a new symmetric multiprocessor product line either late this year or early in 1992. —*Paul Pinella*

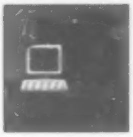
SCIENCE APPLICATIONS INTERNATIONAL CORP.

10260 CAMPUS POINT DRIVE
SAN DIEGO, CA 92121
(619)-546-6000

RANK 46
IS REVENUE $569.0 M

Despite the recent success of high-tech weapons in the war with Iraq, the arms binge of the 1980s is over. That means tough times for weapons and aerospace manufacturers. But for companies like Science Applications International Corp., which provide the software, services and the expertise to keep the U.S. military machine running smoothly, things are different.

The 12,000-strong, employee-owned firm is a major player in the defense-oriented professional services market. SAIC raked in $1.16 billion in revenue in 1990, up 14% over the previous year. According to Jim Russell, senior vice president of corporate business development at SAIC's office in McLean, Va., nonweapons business that was primarily IS-oriented accounted for $569 million in 1990



revenue, an increase of nearly 19% over the previous year.

SAIC is in the midst of a $1 billion, eight-year contract to integrate information systems for the Pentagon's hospital network. Last year, SAIC won a $50 million contract to overhaul IS for the Department of Veterans Affairs's 170 hospitals and another $84 million contract to build a nationwide packet-switching network for the VA.

SAIC is honing its skills on nonmilitary federal government projects as part of a long-range plan to increase its role as a provider of system integration services to the private sector. According to Russell, SAIC wants to see commercial contracts account for 10 to 14% of its overall revenues by the mid-1990s.

SAIC is anxious to team up with computer and telecommunications companies for joint ventures in systems integration. Two areas in which SAIC wants to focus are document-imaging systems and geographical information systems. SAIC is also positioning itself to compete for facilities management contracts. It already has its first one: SAIC was chosen in 1990 by the Department of Energy to run its Albuquerque data center, a five-year, $32 million contract.—*Joe Kelly*

MARTIN MARIETTA CORP.

6801 ROCKLEDGE DRIVE
BETHESDA, MD 20817
(301)-897-6000

RANK
47
IS REVENUE
$549.4 M

In 1990, Martin Marietta Corp. rearranged the structure that generated $549.4 million in external IS sales in 1990—the Chantilly, Va.-based Information Systems Group (ISG)—in the name of cost cutting. Four hundred jobs were eliminated as a result.

The company folded together four ISG units—Civil Information Systems, Internal Information Systems, Postal Information Systems and Simulation Systems—dubbing them Martin Marietta Information Systems, and folding that into the Electronics Information and Missiles Group, based in Orlando, Fla.

Overall, 1990 turned out to be a good year for Martin Marietta. The company had seen defense dollars dry up in the past few years—leading it to eliminate 3,500 jobs corporatewide during the year. But Persian Gulf hostilities brought renewed vigor to the company's defense projects and new IS contracts. Corporate revenues grew $330 million to $6.13 billion during the year. Virtually all of this growth came from the company's IS businesses. Total IS revenues came to $820 million in 1990; however, one-third of that was generated from internal IS sales to other Martin Marietta divisions.

The company's Information Systems arm won a $70 million contract to modernize the Air Force Logistics Command's computerized equipment management system. The system tracks all Air Force equipment inventory, excluding weapons. The Simulation Systems division continued work on a multiyear contract to operate the Strategic Defense Initiative (SDI) Test Bed, a computer simulator for the Department of Defense. The work yields about $150 million in IS revenues annually for Martin Marietta.

New nondefense government business won in 1990 included a $526 million contract to consolidate the U.S. Department of Housing and Urban Development's separate data systems into a single network.—*Mike Ricciuti*

DELL COMPUTER CORP.

9505 ARBORETUM BOULEVARD
AUSTIN, TX 78759
(512)-338-4400

RANK
48
IS REVENUE
$546.0 M

For 1990, Dell Computer Corp. seemed to show signs of maturity that many analysts felt had been lacking since Michael Dell began building computers in his college apartment in the early 1980s. The company's management remained stable for the first time in memory, well-timed products hit the market and some key relationships with distributors were established.

To top it all off, the company made a solid profit, particularly in the second half of the year, when recession jitters were hurting other computer companies. During the company's fiscal year, which ended February 2, 1991, it reported revenue of $546 million, up more than 40% from the previous year's $389 million. Net earnings hit a solid, and better than expected, $27.2 million.

According to Eric C. Zimits of the Dallas-based brokerage house Rauscher Pierce Refsnes Inc., Dell's distribution is shifting more toward value-added resellers (11%) and national accounts (41%), although direct telemarketing sales still account for about half of Dell's sales (48%).

That distribution shift may be even more apparent this year, as a deal with CompUSA Inc. (formerly Soft Warehouse Inc.) will send Dell computers through the retail channel for the first time. Meanwhile, Dell has begun to supply computers to large-scale systems integrators such as Andersen Consulting and Electronic Data Systems Corp.

Dell entered the UNIX market in 1990 with the introduction of the Dell Station PC, based on the company's 325E and 425E PCs. The Dell Station comes preconfigured with UNIX System V, office automation software from Uniplex and X.desktop, a desktop file manager. Dell also enhanced several of its bread-and-butter offerings last year, adding speed to its laptop 320LT and introducing some midsized desktop machines and two 6.4-pound notebook computers, the 212N and 320N. Many other notebook PC manufacturers are having trouble meeting demand for these systems due to a shortage of parts. Dell officials admit they may face the same problems in the future.

Overseas sales increased to 34% of the company's sales, up from 23% the previous year. To better service this business in Europe, Dell has announced that it is opening a manufacturing plant in Ireland, which should be in operation by early summer.

—*Bob Francis*

DUN & BRADSTREET CORP.

299 PARK AVENUE
NEW YORK, NY 10171
(212)-593-6800

RANK
49
IS REVENUE
$539.0 M

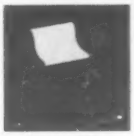
Dun & Bradstreet Corp. continues to try to prove to the world that bigger means better. Last year, the financial information and services giant pushed revenues up by $500 million, or nearly 12%, to approach $5 billion.

But while D&B's 1990 revenues jumped, operating costs increased even more, by $590 million. The result: net earnings dropped 13%, falling some $78 million to $508 million companywide last year.

The good news is that one major sector of D&B had a very strong year. The new Dun & Bradstreet Software Services Inc. had software revenue of $539 million in 1990. D&B Software was born in late 1989 from the marriage of software industry competitors Management Science America Inc. and McCormack & Dodge Corp.

D&B Software made the marriage work last year, bringing formerly competing staffs and products—and a combined 10,000 customers—into one family. Says D&B Software chairman John Imlay, "We knew the merger would give us a powerful market position... But it was a real challenge to bring together two formerly fierce competitors and mold them into one efficient unit."

D&B Software restructured and reduced duplicated staff, squeezing some 700 positions out of the new division's original total of 4,100.



Then the firm invested heavily in customer support services and systems, plunking down 25% of all research and development funds for support and announcing some 20 new products or product enhancements for existing customers. And finally, D&B Software set out a long-term technology strategy to bring together the two product lines under a future open-systems (read UNIX) architecture, which will include a strong dose of client/server-based distributed-computing capability.—*J. William Semich*

NOVELL INC.

122 EAST 1700 SOUTH
SOUTH PROVO, UT 84606
(800)-453-1267

RANK
50
IS REVENUE
$497.5 M

Novell Inc. last year moved forcefully into the corporatewide computing arena, selling $90 million worth of NetWare 386. This network operating system, aimed squarely at larger, more sophisticated networks, amounted to 18% of the company's revenues. This year, with a little help from IBM, the product is expected to account for 35% of revenues, says James R. Tolonen, Novell's chief financial officer.

Revenues for all products hit $497.5 million, up almost 16% from $429.9 million in 1989. That was enough to give Novell a 57% share of the network OS market. Net earnings of $94.3 million was a sizable 79% increase over the $52.6 million of 1989.

Novell continued to generate new products in 1990. In May, 1990 it introduced the eighth generation of NetWare, its version 3.1 of NetWare 386, followed in early 1991 by version 3.11. These releases extend interoperability to non-DOS clients (Macintosh, UNIX, OS/2 machines) and provide a way to integrate third-party applications on the server.

In the spring, Hewlett-Packard Co. licensed the Portable NetWare networking software, which turns HP's model 9000 reduced instruction set computing (RISC) minicomputer into a file and print server for NetWare networks. HP is one of a dozen manufacturers that have signed licensing agreements for Portable NetWare.

In January of this year, Novell began shipping beta versions of its NetWare 3.1J software to Novell K.K., the company's Tokyo-based joint venture with Japanese software distributor Softbank Corp. At the end of 1990, the company brought in to the venture five additional Japanese computer heavyweights as investment partners: Canon Inc., Fujitsu Ltd., NEC Corp., Sony Corp. and Toshiba Corp., which had been technology partners only. Novell retains the majority interest.

The most intriguing development to watch for in 1991 is Novell's licensing, distribution and support agreement with IBM, under which Big Blue will market, service and support Novell's products, including NetWare 386. At minimum, the agreement will boost Novell's credibility and sales among corporate IS staffs who might otherwise lean toward LAN Manager or LAN Server.—*Tom McCusker*

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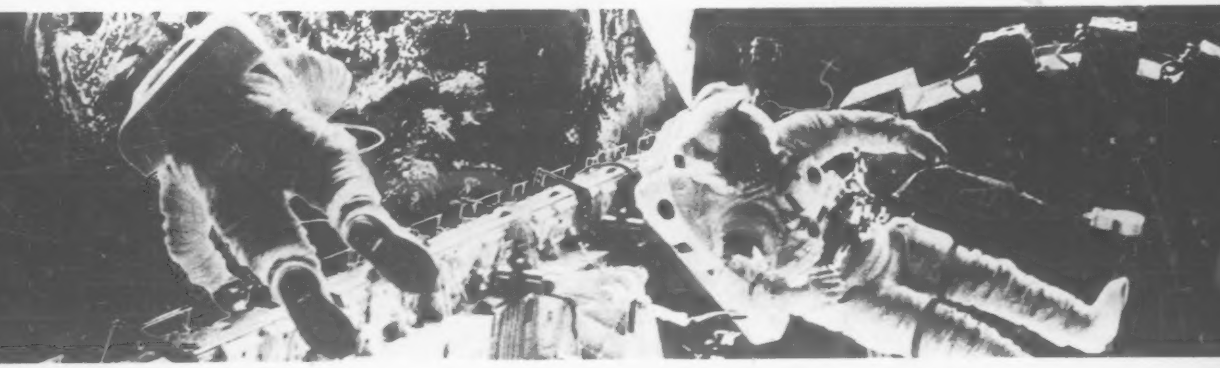

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THE DATAMATION 100

PROFILES 51 - 75

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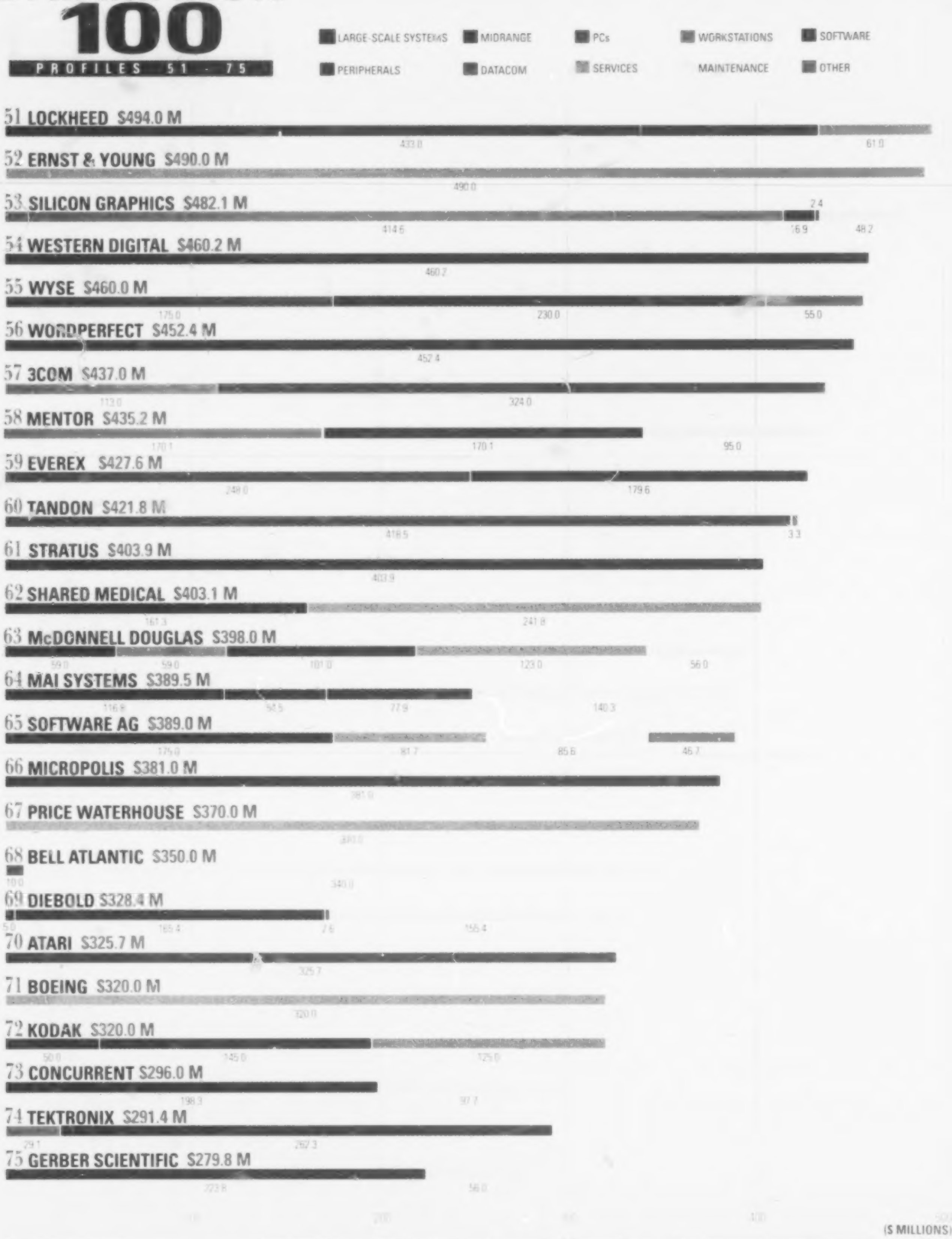


LOCKHEED CORP.

4500 PARK GRANADA BOULEVARD
CALABASAS, CA 91399
(818)-712-2000

RANK
51
IS REVENUE
$494.0 M

In the early 1980s, flush with profits from its defense and aerospace business, Lockheed Corp. boldly marched into IS with a string of acquisitions in software, information services and graphics systems. Later in the decade, however, Lockheed realized it had strayed too far from its core markets, and it felt heat from corporate raider Harold C. Simmons, who launched an ambitious takeover attempt.

Over the last three years, Lockheed has been selling off IS subsidiaries as part of a corporate plan of restructuring and belt tightening. Dialog Information Services went to Knight-Ridder Inc.; CADAM Inc. to IBM; and, in March of 1990, Lockheed unloaded Metier Inc., a leading vendor of project management software, by selling it to Lucas Industries PLC of Birmingham, U.K.

All that's left of Lockheed's IS business are CalComp, a manufacturer of computer graphics peripherals, and Lockheed Information Management Systems Inc., formerly known as Datacom Systems Corp. Lockheed IMS sells systems for processing parking tickets and other fines to state and local governments around the country. Together, the two subsidiaries accounted for IS revenues of $494 million, just under 5% of Lockheed's total 1990 sales of $10 billion. For 1990, Lockheed's fortunes have soared like its F-117 Stealth fighter. It reported corporate earnings of $335 million, up from the $2 million reported in 1989. And in March of this year, Simmons dropped his takeover attempt.

CalComp, which makes plotters, digitizers and display products, is struggling with a major product transition and bruising competition from other graphics suppliers. It thrived in the past by selling its products to creators of computer-aided design (CAD) systems. But because the market for CAD systems has slowed, CalComp has been overhauling its entire product line. It now hopes to break into desktop-publishing and other more mainstream corporate markets. In September, CalComp dropped prices from 6 to 16% on its graphics tablets and plotters. It also reorganized its operations, decentralizing into five operating groups, cutting its 2,700 member staff by 5%.

According to William Conlin, CalComp's president, the reorganization will enable the subsidiary to better focus its sales force. "We needed to get more specialized on the sales side to deal with where the industry is going," Conlin says. The price cuts and reorganization are also aimed at strengthening CalComp sales efforts against one of its arch rivals, the much smaller Summagraphics Corp. In 1989, Summagraphics had offered to buy CalComp, which was then up for sale, but the talks did not pan out. Later, Lockheed took CalComp off the auction block.

Conlin said CalComp had a strong showing in Europe in 1990, which accounted for just under half of its sales. However, sales were essentially flat in its North American and Far Eastern markets.—*Joe Kelly*

ERNST & YOUNG

787 SEVENTH AVENUE
NEW YORK, NY 10019
(212)-830-6000

RANK
52
IS REVENUE
$490.0 M

Ernst & Young is one of the largest professional services firms in the United States. Worldwide revenues from IS services totaled $490 million last year—not bad for a one-year-old company. Ernst & Young was born in 1989 from the merger of two accounting giants, Ernst & Whinney and Arthur Young & Co., and the firm says it has benefited from its new heft.

"The trend is toward big companies," says Alan Stanford, national director of information systems consulting at Ernst & Young. "It is now the 'Day Of The Large Firms,' with companies like EDS, Andersen Consulting and IBM. The market has made the statement that you've got to be big-scale. The age of the globally positioned service providers is clearly with us." The company has offices in over 100 cities worldwide and serves clients in numerous vertical markets, including manufacturing, energy, transportation, utilities, retail, finance, insurance and health care.

In June, Ernst & Young announced the Navigator System Series service, a comprehensive methodology for building information systems. The Navigator System comprises design, implementation and project management tools, documentation and consulting services for developing large-scale systems. Although not a computer-aided software engineering tool, Navigator works with CASE products, such as the Information Engineering Workbench set of tools from KnowledgeWare Inc., an Ernst & Young subsidiary. Navigator is also compliant with IBM's AD/Cycle CASE system.

"Navigator has gotten a very strong reception—it is in place in over 50 sites at *Fortune* 100 companies," says Stanford. Release 1.5, a maintenance version, is expected to be announced in June.

In November of last year, Ernst & Young opened the Center for Information Technology and Strategy in Boston. Designed as a think tank for creating strategies for information technology implementation, the center offers clients research and advisory services. As such, the center competes directly with the technology-planning functions of such market research firms as Arthur D. Little Inc., the Gartner Group Inc., and Index Technology Corp.

One of the major projects now under way at the center is the Integration Challenge, through which the center is working with about 20 *Fortune* 100 companies to determine how IT can be used to integrate a company's operations. The Boston center joins Ernst & Young's other research centers, the Advanced CASE Technology Center in Ann Arbor, Mich., and the just opened Advanced System Center in Las Colinas, Texas.

—*Sarah Lindsey*

SILICON GRAPHICS INC.

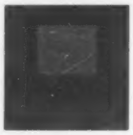
2011 NORTH SHORELINE BOULEVARD
MOUNTAIN VIEW, CA 94039
(415)-960-1980

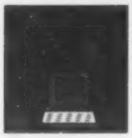
RANK
53
IS REVENUE
$482.1 M

Silicon Graphics Inc.'s focus on high-end graphics technology for the technical-computing market helped it boost sales almost 41% last year, rising to $482 million from 1989's $343 million.

SGI thinks this specialization in what it calls the visual-processing part of the graphics market will reap rewards in the future, too. "We think that the visual-processing market will grow from $1 billion today to a $5 billion to $6 billion market by 1995.While others move their products into the commercial market to replace PCs, we will focus strictly on the technical side," says executive vice president Mark Perry.

Dataquest Inc. ranks Silicon Graphics fifth in the $6 billion workstation market behind Sun Microsystems Inc., Hewlett-Packard Co., Digital Equipment Corp. and Intergraph Corp. The San Francisco-based investment banking firm, Montgomery Securities says that Silicon Graphics has a two-year lead in hardware, operating system software and application software relative to its competitors. By the end of 1990, there were 522 third-party vendors providing 1,025 three-dimensional graphics software applications for Silicon Graphics's machines.





Silicon Graphics's workstations and servers are built around reduced instruction set computing (RISC) microprocessors from Mips Computer Systems Inc. The line of binary-compatible machines ranges from $10,000 workstations to supercomputer-like models. Major 1990 product introductions included the announcement of a trio of workstations: the high-end 4D/200 POWER series, the 4D/300 series and the POWERVISION series. The company also released NetVisualizer, a visual network diagnostic tool, and the IRISVision 3D graphics board, which brings 3D graphics performance to 80386- and 80486-based PCs.

At the end of 1990, there was a small drop in U.S. business, largely due to a decline in sales to the Department of Defense and delays in the approval of the federal budget; 40% of Silicon Graphics's U.S. business comes from government contracts. The company expects the Gulf War to have a positive effect on future sales to the DOD. The 1991 federal budget also proposes 10% budget increases to both the Environmental Protection Agency and the National Aeronautics and Space Administration, two important government customers for the company.—*Sarah Lindsey*

WESTERN DIGITAL CORP.

8105 IRVINE CENTER DRIVE
IRVINE, CA 92718
(714)-932-5000

RANK
54
IS REVENUE
$460.2 M

Storage and circuit manufacturer Western Digital Corp. became a billion-dollar baby in 1990 ($460 million of it generated by IS related business). But the company's once rosy profits plummeted like a lead weight by year's end. After chalking up net earnings of $31.9 million in 1989, the company reported a stinging $78.6 million loss in 1990. Precipitating the profit plunge was a one-time write-off of $66 million taken in December to cover restructuring costs.

Changing market conditions, resulting in a shift away from Western Digital's increasingly commodity-like printed circuit board business, took much of the blame. "Essentially, we deemphasized the board business," relates Robert Blair, Western Digital's vice president of investor relations. In its place, the company ramped up production of its successful integrated circuit technology, including the WD7600 chip set for laptop and desktop PCs and the WD90C20VGA video device.

Meanwhile, the company jettisoned its older line of low-end storage and video controller boards, opting to concentrate more on its intelligent 3½-inch disk drive business. Distribution strategies shifted more toward original equipment manufacturers (OEMs) and less toward resellers.

IBM's reentry into the laptop market, if successful, should help Western Digital's revenue in the second half of 1991. Western Digital says it has significant contracts to design and build the circuit boards for IBM's new seven-pound laptop, the PS/2 L 40SX. Also crucial to the company's immediate future will be its ability to deliver a new generation of 2½-inch disk drives for smaller notebook computers. As Blair puts it: "Our ability to get those to market and do it well will directly impact the company's bottom line performance in 1991."—*John McMullen*

WYSE TECHNOLOGY

3471 NORTH FIRST STREET
SAN JOSE, CA 95134
(408)-473-1200

RANK
55
IS REVENUE
$460.0 M

Two years ago, many thought Wyse Technology would end up like many second-tier manufacturers of PC-compatibles—a once fast-rising star that burned out. The red ink was flowing copiously when a group of Taiwanese investors, called Channel International Corp., stepped in and purchased the company in January 1990. And, officials at the now privately owned company say Wyse has turned a profit for three consecutive quarters.

There's still much to be done, admits Daniel Wu, who has been president since the acquisition. "But we feel we have turned the corner," he says. That turnaround has come about primarily through Wyse's terminals business, which accounts for more than 50% of revenue and is growing at more than 15% annually. As a result, Wu plans to increase spending on research and development for terminals by 50% next year. But already the increased attention to terminals is paying off. In October, Wyse entered the emerging X terminal market and hired Arthur Li[illegible] from Xerox Corp. as group general manager.

In previous years, Wyse missed out on opportunities in the PC-compatible market by not getting products to market faster. Last year, to rectify that situation, Wyse made its systems architecture easier to adapt to changing technologies. As a result, last September the company introduced several new products, including a high-end 80486 machine, a family of slim 80386SX PCs and a number of lower priced PCs. Then in March 1991, Wyse announced a 25-megahertz version of its 486 PC, along with a 20MHz version of its 386SX line. Although PC sales apparently are improving, Dataquest Inc. analyst Ronald Cooke doesn't believe the company's PC group is profitable yet.

Many analysts say Wyse's future lies in its family of UNIX-based high-end workstations and network servers, which were introduced in January 1990 and received favorable reviews. The series 9000i server is powered by eight 486 microprocessors, can handle 250 users and is priced at about $250,000. Last year, Wyse hired Richard Wesson to manage the Advanced Systems Group, which manufactures 9000i. Wesson previously was president and chief executive officer of Voysys Corp., a supplier of voice-processing systems.

Like many U.S. computer companies, Wyse's business is shifting overseas. In 1990, 40% of the company's revenue was generated outside the United States, up from 30% in 1989. That trend will likely continue, says Wu, particularly as Wyse's terminals business increases overseas. "Last year, we wanted to improve our cash flow position," says Wu. "We've done that. This year, our slogan is 'growth.'"—*Bob Francis*

WORDPERFECT CORP.

1555 NORTH TECHNOLOGY WAY
OREM, UT 84057
(801)-225-5000

RANK
56
IS REVENUE
$452.4 M

Even though WordPerfect Corp. has yet to offer a Windows 3.0 version of its classic word-processing software, the company flourished in 1990 and is likely to do so again in 1991. Strong commitment from a long-established user base combined with a product that is available on virtually every type hardware platform have served the company well in the fast-changing word-processing market.

Boasting, by its own account, an overwhelming 65% share of the MS-DOS word-processing market, WordPerfect reached $452.4 million in revenues last year, a 61% increase over 1989's $281.4 million. The company expects revenue to top the $600 million mark in 1991, for an increase of almost 33%.

Alan Ashton, WordPerfect's president and founder, says such expectations are not unreasonable. He even labels the privately held company "recession-proof."

WordPerfect continues to follow a careful and deliberate approach to the Windows marketplace. After more than a year of development, WordPerfect 5.1 For Windows will be widely available this summer. As a result, Ashton anticipates a big second half revenue boost. WordPerfect 5.1 For DOS and WordPerfect 5.1 For Windows are file compatible. The Windows version will require no conversion in the underlying file format, which is currently required to import word-processing files into Windows.

WordPerfect will not push the Windows release as the preferred version of the word-processing software, either. Says Ashton: "A lot of people are not aware of the additional hardware and memory required to run Microsoft Windows. For those not yet willing to upgrade the hardware, DOS may remain the preferred operating environment. For others, it may be Windows."

WordPerfect also hopes to ship Windows versions of two complementary products: the DrawPerfect graphics program and Office, which includes e-mail, calendar and scheduling software.

WordPerfect's word-processing products still dominate the company's sales, contributing 80% ($360 million) of the firm's 1990 revenue. DrawPerfect kicked in an additional $11 million in sales, which was a pleasant surprise, says Ashton. Office, available for the IBM PC and the Macintosh, as well as for UNIX workstations, generated $14 million. Ashton believes Office will blossom into a major contributor in another year or two.—*John McMullen*

3COM CORP.

5400 BAYFRONT PLAZA
SANTA CLARA, CA 95052
(408)-764-5000

RANK
57
IS REVENUE
$437.0 M

Modest gains in sales and lower earnings forced 3Com Corp. to reexamine both its identity and its strategy, leading to major shifts in both areas. In the first week of 1991, the company announced what had long been rumored: it would sell off its work-group-related businesses, including the LAN Manager operating system, and center its attention instead on network adapters and enterprise-networking systems such as bridges and routers. Putting it rather grandly, 3Com said it intended to focus on "global data networking."

Perhaps a first hint of its intention to bow to reality came in August when 3Com announced support for archrival Novell Inc.'s top-selling NetWare system software. But the big news occurred when 3Com handed off the rights for LAN Manager to Microsoft Corp., which had created the system with 3Com. The company also exited the network server, stations and Systems Network Architecture (SNA) work group connectivity markets. Implementing this new strategy cost 3Com a hefty one-time charge to net income of approximately $67 million in the quarter that ended February 28, 1991. The firm also reduced its work force by 150 people.

On the executive front, 3Com closed the books on some well-known names. Eric Benhamou, who came to 3Com when it merged with Bridge Communications Inc. in 1987, was named chief executive officer in August. He took over from Bill Krause, who held the job for nearly a decade and continues as chairman. Founder and director Robert Metcalfe retired in June at the ripe old age of 44.

The good news was that 32% of total sales in the quarter that ended in November 1990 were derived from new products such as 10BaseT adapters for unshielded twisted pair Ethernet networks. Some 12% of total sales went toward research and development expenses, a good bit more than the 9.3% spent in 1988. 3Com will maintain this rate of R&D spending, but hopes it can boost its position in the internetworking market by spreading those expenditures out over fewer products. International sales also increased steadily, amounting to 44% of total sales in the last quarter of 1990, up 11% from the comparable quarter in 1989.

"The company was really invested in too many things, and we needed to refocus for the 1990s," says Benhamou. "The big steps have all been taken and announced, and there are no surprises in the wings. We're perfectly positioned with the right amount of resources."—*Susan Kerr*

MENTOR GRAPHICS CORP.

8005 SOUTHWEST BOECKMAN ROAD
WILSONVILLE, OR 97070
(503)-685-7000

RANK
58
IS REVENUE
$435.2 M

Newly located in Wilsonville, Ore., a pleasant, wooded community just outside Portland, Mentor Graphics Corp. reported a generally favorable year in terms of gross revenue. Nonetheless, reduced earnings growth kept this 10-year-old market leader in integrated circuit (IC) and electronic design automation (EDA) from having an entirely pleasant year.

Mentor entered 1990 with record sales growth, rising profits and a strong balance sheet. Early in the year, it announced the acquisition of Silicon Compiler Systems Corp., a San Jose-based supplier of IC design software for Sun workstations. This was followed by a $15 million order from Texas Instruments Inc. for IC design applications which, Mentor boasts, is the small EDA industry's largest ever contract.

Mentor also unveiled last year an aggressive shipping schedule for the latest generation, release 8.0., of its IDEA Series design automation software.

The Silicon Compiler acquisition gave Mentor a speedy route into the fast-growing Sun workstation software market; analysts had worried that Mentor's single-platform Apollo/HP-based product strategy would thwart the company's ability to expand into new markets. The move also added about 400 people to the company, bringing staff up to over 2,700.

Workstation revenue from the top 100 North American companies grew 34.7% in 1990.

But even in quiet little Wilsonville, world events can take their toll. Mentor's revenue fell as the recession intensified over the summer.

That doesn't explain why the company's much-ballyhood new release 8.0 fell so far behind schedule, however. Dates for both the HP/Apollo and Sun versions were pushed from late summer to the first quarter 1991 as the year wore on.

Thomas Bruggere, chairman and chief executive officer, admits that Mentor at first underestimated the size and scope of the release 8.0 development project. But now that the software has begun to be shipped, he predicts customers will be pleased with it. "It's the first true framework [type product] in the electronic design automation industry, and that's a big plus," he says, predicting that third-party software companies will support it with their own packages. By "framework," Bruggere means the product is modular and open to other EDA vendors' products.

The actual shipment of release 8.0 and associated Mentor applications on Sun and HP/Apollo platforms will dominate the news this year. And, while Bruggere won't say for sure, IBM's RS/6000 workstation remains a distinct possibility as Mentor's next big platform push.—*Paul Pinella*

EVEREX SYSTEMS INC.

48431 MILMONT DRIVE
FREMONT, CA 94538
(415)-498-1111

RANK
59
IS REVENUE
$427.6 M

The deepening U.S. recession and a possible over reliance on domestic rather than international accounts put the brakes on fast-growing Everex Systems Inc. in 1990.

The PC and peripherals supplier learned that even the best laid plans can go awry. An aggressive telemarketer, Everex has used its sales staffs' extensive customer contacts to supply market intelligence to product engineers. That has made Everex responsive, but has deprived the company of a dealer pipeline to protect it from market fluctuations. Everex was already hurting from the slowdown in PC sales by the time its competitors first started feeling the pinch.

But the recession wasn't the only spoiler during the year. With only 10% of its revenues coming from overseas operations, Everex missed out on growing international markets and potential currency translation benefits.

"We also fell behind in product development—not in features and performance, but in the cost/production of our products," says Kimball Brown, director of investor relations at Everex. Brown says Everex continued using expensive discrete components while competitors embraced lower cost chip sets. "So our products got relatively more expensive than the competitors'," he explains. The situation culminated in February of 1991 with a 19% work force reduction cutting approximately 500 employees.

However, not all the 1990 news was negative. Following the summer announcement of its Tempo LX family of notebook PCs, Everex joined Compaq Computer Corp. as the only suppliers to actually ship notebook computers based on the 386SX microprocessor, although many others will follow this year. Meanwhile, the company's large investment in research and development paid off early in 1991 as more compact, reengineered desktop systems came on line with additional integrated components. "Those systems are now becoming a larger part of the revenue stream," says Brown.

Midrange revenue from the top 100 North American companies grew 12% in 1990.

While the Everex outlook for 1991 remains clouded by the economy, the company has taken steps to reform. In February, Everex named former Ingram Micro D executive Harold Clark as president and chief operating officer. Analysts say that frees former president and chief executive officer Steve L.W.

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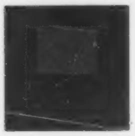

Hui to focus more on R&D in his new role as CEO and chairman. Meanwhile, Brown says that a new family of lighter weight notebook computers will be out by this summer, and that should be followed by an Intel-based multiprocessor system.—*Paul Pinella*

TANDON CORP.

301 SCIENCE DRIVE
MOORPARK, CA 93021
(805)-529-0340

RANK
60
IS REVENUE
$421.8 M

Back in the early 1980s when Tandon was best known as a disk drive manufacturer, it was also busy making PCs and supplying them to Tandem Corp., Tandy Corp.'s Radio Shack outlets and European computer companies.

So it was not a complete surprise when Tandon abandoned its troubled disk drive business in 1987 and started selling just PCs. What is a surprise is how successful Tandon has become competing against the likes of Compaq Computer Corp. and IBM.

In 1990, Tandon's revenue rose almost 12% to $421.8 million. And after years of running in the red, Tandon reported a net income of $25.6 million. The success in 1990 has prompted Sirjang Lal Tandon, who founded Tandon in 1976 and remains its chairman, president and chief executive officer, to launch a major assault on the U.S. market, where Tandon now has a negligible presence.

Tandon offers a broad line of PCs, from its notebook-sized Tandon NB/386 SX to the reduced instruction set computing (RISC) UNIX workstations it announced in March of this year. In 1990, more than half of Tandon's sales were of PCs based on the Intel 80386 and 80486 chips. Sales of these high-end personal computers produced an average profit margin of 30% for the year. Tandon's bottom line also benefited from the weakness of the U.S. dollar versus the West European currencies, where it derived 94% of its sales. Tandon maintains a network of more than 3,000 dealers throughout Europe.

To become a force in Canada and the United States, Tandon has recruited more than 250 dealers and value-added resellers, including marketing agreements with the Walden-software chain of 60 retail stores and also with INMAC Corp., the large direct response/catalogue marketer of computer products. Heading up Tandon's North American effort is computer industry veteran Graham C. Beachum Jr., who has previously been associated with a variety of PC manufacturers including Dell Computer Corp., IBM, Northgate Computer Systems and Tandy.

Tandon's family of RISC workstations will be based on the product line from Solbourne Computer Inc., the Longmont Colo.-based supplier of systems based on Sun Microsystems Inc.'s Scalable Processor Architecture (SPARC). Tandon will market the Solbourne line under its own name and also has manufacturing rights.—*Joe Kelly*

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MARLBOROUGH, MA 01752
(508)-460-2000

RANK 61
IS REVENUE $403.9 M

Stratus Computer Inc. fared well during last year's uncertain economic climate. This relatively small ($403.9 million) vendor of fault-tolerant computers has grown steadily over the last 10 years, primarily by selling its machines in traditional markets for on-line transaction processing—automatic teller networks, stock trading and credit card authorization firms. Last year, revenue growth of 18% and earnings growth of 4.5% came primarily from overseas expansion and sales to new markets such as telecommunications, retail and distribution.

Stratus has no choice but to garner new customers; original equipment manufacturer (OEM) IBM is selling fewer Stratus systems these days. Since 1985, IBM has resold Stratus systems under its own System/88 banner. Last year, IBM-derived revenue fell to 23% of Stratus revenues, down from 30% in 1989. Stratus officials say the relationship has matured, and IBM is not aggressively marketing the System/88. The company expects IBM-derived revenue to remain flat or even to drop further.

Rather than relying on existing OEMs IBM and Ing. C. Olivetti & Co. (which brought in 6% of the company's revenue last year), Stratus is appealing to new customers through a renewed emphasis on direct sales, particularly overseas. And it has built an armory of new products, both in its existing VOS line and its new UNIX-based systems.

Although the telecommunications market is a good one for makers of fault-tolerant systems, the UNIX systems Stratus announced early last year didn't perform as well as it had expected. This year, however, Stratus made headway by signing OEM contracts with LMEricsson Telephone Co. and NEC Corp., both of which sell to telecom companies. Those contracts are dependent on Stratus systems introduced in March 1991 that are based on the Intel i860 reduced instruction set computing (RISC) chip. Eventually, Stratus will build all of its systems on RISC engines.

A 30% gain nets Stratus No. 9 in North American midrange vendors.

International direct sales grew a healthy 48% last year. Almost half of Stratus's revenue comes from outside North America, and chief executive officer Bill Foster says Stratus has only "scratched the surface of Western Europe." Japanese customers, who tend to go outside Japan only for advanced technology, snapped up fault-tolerant systems from Stratus and competitor Tandem Computers Inc. last year, as the country's financial services industry continues to grow.—*Elaine L. Appleton*

SHARED MEDICAL SYSTEMS CORP.

51 VALLEY STREAM PARKWAY
MALVERN, PA 1935
(215)-296-6300

RANK 62
IS REVENUE $403.1 M

Shared Medical Systems Corp. had a healthy year in terms of revenue, breaking the $400 million barrier for the first time. That was only a 3.4% increase over 1989's revenue, but that's good in the hospital information system (HIS) field, which was essentially flat.

According to Jonathan Osgood, principal at the market research firm Alex. Brown & Sons Inc., 1990 "was a turnaround year for SMS. For four years, they've been scrambling to revamp their product line and make themselves more competitive. They changed a lot of the players, restructured the organization. That began to pay off in 1990, even though earnings didn't really show it." In fact, earnings actually dipped slightly from $23.1 million in 1989 to $22.7 million in 1990.

The major drivers for SMS in 1990 were the upgrade of its hospital information system for Digital Equipment Corp. machines and the first shipments of its IBM-based HIS.

Unity, introduced in March 1990, upgraded the Digital system, which is used by SMS's largest customer group. SMS added new applications and clinical management functions to this HIS, which replaces the older FMS Exact product. Unity makes greater use of distributed processing and local area networking. Half of SMS's Digital customers upgraded to Unity last year.

Perhaps more critical to SMS's future was the successful launch of Invision in the fall of 1989. The company began shipping this HIS for IBM machines in 1990, with good results. Ninety-seven clients, representing 127 hospitals, placed orders. Half were new clients, and half were upgrading from SMS's Independence line.

"For the first time in a while, Hospital Systems Division orders increased year over year," says Osgood. "Overseas business had a very good year and, for the first time, turned a slight profit."

Those kinds of results should help keep SMS at the top of the independent HIS provider list, as many other vendors struggle to stay in the black and grow in this highly competitive field.—*Mark Schlack*

McDONNELL DOUGLAS CORP.

J.S. McDONNELL BOULEVARD
AND AIRPORT ROAD
ST. LOUIS, MO 63166
(314)-232-0232

RANK 63
IS REVENUE $398.0 M

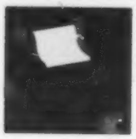
McDonnell Douglas Corp.'s IS subsidiary has been trying to be many things to many people. But two years ago, executives who ran the unprofitable subsidiary—then known as McDonnell Douglas Information Systems Co.—had sworn to a more narrow agenda for their slice of the aerospace maker's business.

They certainly kept their promise.

In July of 1989, the IS subsidiary was reorganized and rechristened the McDonnell Douglas Systems Integration Co. (MDSI). Its eight business units became three divisions. Previously acquired companies like United Computing and Microdata Corp. were consolidated or dismantled. And the company sold Tymnet, its networking services arm, to British Telecommunications PLC.

What's left is a much smaller IS business—and a much more focused one. Instead of a monolith with $1.3 billion in 1988 IS revenue, the company's revenue from systems and services now totals $398 million worldwide. However, the company is now making money in IS, earning $15 million in 1990.

The subsidiary is generating these profits through its ability to concentrate on selling a single function—systems integration services—to outside vendors. MDSI's three divisions supply products and services to commercial and government users. The Manufacturing & Engineering Division concentrates on computer-aided design, manufacturing and engineering. It features the Unigraphics 3-D CAD/CAM package and Infomanager, a data management integration package. The Infrastructure Solutions Division partners with government agencies, like the Massachusetts Water Resources Authority, and with architectural firms to implement McDonnell Douglas's Graphics



Design System database for site planning and structural analysis. The Industry Information Services Division offers services like outsourcing to users in such industries as insurance and telecommunications.

Almost a third of the company's IS revenue comes from outside the United States. Its international managers target users, like GM, that approach business globally. "Although you might have a problem in West Germany or Tokyo, we want to assure our customers that there's one person to call if you have to," says Mark Kuhlmann, newly appointed senior vice president/general counsel of McDonnell Douglas Corp. Earlier this year, the company hit a target of a different sort when Fujitsu Ltd. agreed to resell MDSI's Unigraphics software in Japan to run on Fujitsu's S-family of engineering workstations.

Twenty-five-year McDonnell Douglas veteran John Mazzola succeeded Kuhlmann as president of MDSI in April of 1991.

—Steve Paul

MAI Systems Corp.

14101 Myford Road
Tustin, CA 92680
(714)-731-5100

RANK
64
IS REVENUE
$389.5 M

MAI Systems Corp. took on a new name and a new strategy in 1990, none of which seemed to help its balance sheet. Revenue remained virtually unchanged from last year, with losses nearly double those of 1989. The company's poor performance stems from the generally low demand for midrange computers, as well from MAI's failure to introduce new models within the past two years.

In fact, MAI got out of the business of making minicomputers last year, preferring the role of a value added reseller. Last November the company changed its name from MAI Basic Four Inc. to MAI Systems Corp. to reflect that transition. But most of its revenue (93%) still came from its own systems last year. It will take another two years before the company is able to generate a majority of its revenue from the VAR program, says Fred D. Anderson Jr., the company's president and chief operating officer.

Anderson expects VAR sales, primarily from Hewlett-Packard Co. systems, to account for 25 to 30% of revenue this year and 50% in 1992. In 1993, says Anderson, 80% of MAI's revenue will come from VAR sales.

As a VAR, MAI adds its applications software to computers made by Acer America Corp., Hewlett-Packard, IBM, NCR Corp. and Sequent Computer Systems Inc. This spring, the company added systems from Sun Microsystems Inc. MAI will target industries such as wholesale distribution, manufacturing, health care, hotels, transportation, retail, finance and construction. These are markets in which the company has been targeting its minicomputers for a half dozen years.

The software applications are written in Business BASIC. Last year, MAI introduced Open BASIC, an application environment that permits applications written in Business BASIC to run on other kinds of hardware. The firm's GPx product line, featuring the Dual Universe operating system, allows users to run applications written in either UNIX or Business BASIC concurrently.

As part of its transition to a VAR, MAI trimmed its staff by 400 and now has 3,500 employees worldwide. It also consolidated U.S. sales and service locations, taking a $59.7 million charge late in the summer.

In MAI's corporate offices, chief executive officer and chairman William Weksel resigned. He was replaced by Bennett S. LeBow, a director and chairman of the executive committee.*—Tom McCusker*

Software AG

11190 Sunrise Valley Drive
Reston, VA 22091
(703)-860-5050

RANK
65
IS REVENUE
$389.0 M

For Software AG, 1990 was a year of streamlining, strengthening and stretching. Internally, the firm reorganized itself into a single worldwide company with management responsibilities split between Reston, Va., and Darmstadt, Germany. Externally, Software AG fortified its bonds with customers and struck a new partnership with Digital Equipment Corp. It also began flexing its technological and marketing muscle, shaped in the mainframe mold, into newer client/server configurations.

All that activity pumped up the company's revenue by a healthy 32% to $389 million. In the independent software industry, in which many fail and many others barely survive, Software AG not only has survived but thrived. Its success stems from Adabas, the robust database management system that started life as an IBM mainframe-based product. Recently, Adabas and its Natural language sidekick have begun migrating into more heterogeneous hardware realms.

In 1990, the firm made its biggest move into those areas when it unveiled its ambitious Entire family of client/server wares. The company's goal for Entire, says executive vice president Joe Agro, is "to provide an open architecture so our customers can do what they want with their hardware and still protect their investment while building the new systems they need." In fact, Entire's ability to cross multiple platforms independently and transparently is a basic foundation for Software AG's product development and enhancement strategy of the past several years and has provided the company with a strong base of loyal users. Longtime Adabas user Randy Ebeling, assistant data-processing director at the University of Texas at Austin, says, "that basic foundation has convinced us that they are able not only to map out a strategy but also to carry it out, as they're doing with Entire."

Last year, Software AG took steps to beef up customer satisfaction all around by quickly bringing to market several customer-requested add-ons and enhancements to the basic Adabas and Natural products. And the company expanded its professional services organization, which generates 15% of corporate revenue from customer services such as contract programming and turnkey installation of applications.*—Linda Runyan*

Micropolis Corp.

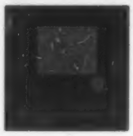
21211 Nordhoff Street
Chatsworth, CA 91311
(818)-709-3300

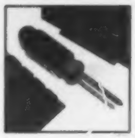
RANK
66
IS REVENUE
$381.0 M

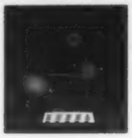
Following a difficult 1989, Micropolis Corp. spent the greater part of 1990 streamlining its manufacturing operations, rethinking distribution channels and going on a new-products binge. Afterwards, this large manufacturer of high-capacity 5¼-inch Winchester disk drives emerged with net earnings of $8 million and revenue of $381 million, a considerable improvement over a $50 million net loss from 1989.

Micropolis's poor 1989 financial performance certainly tested the confidence of its customers, which include original equipment manufacturers (OEMs) and computer systems resellers, admits Craig Ringuette, vice president of marketing. "There was a lot of concern among the industry watchers. At one point, the very survival of Micropolis was seen as very iffy. But we have had continual profitable [quarterly] performances since the second quarter of 1990."

Micropolis supplies disk drives to Digital Equipment Corp., Hewlett-Packard Co., Siemens-Nixdorf Informationssysteme AG







and Sun Microsystems Inc., among others.

The company was able to cut manufacturing costs by moving most of its manufacturing operations from the United States to the Far East, leaving its Chatsworth, Calif., headquarters as a flexible prototype design and development center.

Significant product introductions during 1990 included the fourth-quarter release of the 2-gigabyte model 1548 5¼-inch disk drive and the High Speed (HS) series Small Computer Systems Interface (SCSI) hard drives, which offer access times as low as 3.9 milliseconds.

To encourage increased growth in its distribution channel, Micropolis formed the Storage Systems Division at the very end of last year to provide products and direct support to its strategic resellers.

In the middle of 1989, development work on a high-performance 3½ disk drive was halted because, as the company's 1989 annual report states, "while [a high-performance 3½-inch disk drive] product appeared to be nicely aligned with market needs, the financial resources of the Company [are] inadequate to support additional investments in 1989." This month's pending announcement that Micropolis will offer a 3½-inch high-capacity gigabyte-plus drive may be an indication that the company has become more confident of its financial stability. —*Sarah Lindsey*

PRICE WATERHOUSE

1251 AVENUE OF THE AMERICAS
NEW YORK, NY 10020
(212)-819-5000

RANK 67
IS REVENUE $370.0 M

The button-down image that Price Waterhouse's tax and audit partners have cultivated for years belies the roll-up-your-sleeves attitude that the firm's information services consultants bring to their practice. Their willingness to take on tough IS assignments, such as the massive programming effort involved in overhauling a government agency's human resources system, is winning respect and customers.

The firm's IS revenue has nearly tripled in the past three years, reaching $370 million in 1990. About 80% of its business lies with providing systems integration services to commercial customers; the rest is government work.

Although Price Waterhouse doesn't dismiss competition from other Big Six accounting firms or the service arms of major systems suppliers, the firm sees users themselves as its biggest rivals. "Their own shops are the biggest integrators," says Robert Cawly, managing partner of Price Waterhouse's Applied Technology Center in Tampa, Fla. The firm's challenge, he explains, is to become the so-called enterprise integrator for user organizations—a role that requires Price Waterhouse to show customers cost-effective ways to manage their entire information systems, not just parts of it.

Accordingly, there are four parts to Price Waterhouse's enterprise IS strategy. The firm aims to:

- Use knowledge-based tools to reduce the cost of implementing new applications for users;
- Provide systems reengineering, which means making the most of a user organization's existing code and systems architecture;
- Create industry-specific software for markets in which the firm specializes—notably banking and finance, oil and gas, public utilities, retailing and insurance;
- Introduce change management to organizations, orienting them to structural and strategic changes enabled by developments in technology.

Price Waterhouse distinguishes itself from others as much by what it doesn't do as by what it does. It doesn't provide facilities management (outsourcing) services. Unlike other Big Six firms, it doesn't resell hardware and software, although it does have numerous alliances with major suppliers whose products Price Waterhouse helps its customers install and use. Allies include the Dun & Bradstreet Corp. and Tesseract Corp. in the software realm and Digital Equipment Corp. and IBM on the hardware side.—*Steve Paul*

BELL ATLANTIC CORP.

1600 MARKET STREET
PHILADELPHIA, PA 19103
(215)-963-6000

RANK 68
IS REVENUE $350.0 M

Bell Atlantic Corp. had a respectable 1990, with companywide revenue up 7.4% to $12.3 billion and earnings up 22.1% to $1.3 billion. Bell's information services businesses, consisting largely of maintenance services, contributed $350 million in revenues to the overall revenue figure, 9% more than in 1989.

"Bell Atlantic had a good year," reports Richard C. Munn, president of the market research firm Ledgeway/Dataquest. "They're clearly the largest player in the independent services business."

Bell Atlantic's Business Systems Services division, which offers hardware and software maintenance, has seen its biggest growth in large accounts containing mainframes and complex data networks, says Janet Wallace, division vice president of marketing. The focus on mainframes is something of a departure for the division, which used to focus predominantly on mini and standalone micro business.

This shift in focus was possible in part because Bell Atlantic invested in added IS expertise, which allowed the company to launch the XTRA maintenance program for DEC VAX computers and for IBM mainframes and the AS/400 mini. The new service addresses problems caused by hardware, software and networks.

Although Bell Atlantic grew 9% in 1990, it dropped one spot in the 1990 North American ranking.

In 1990, Bell Atlantic formed a partnership with CGI Consulting Inc. to service local area networks. In the beginning, that partnership will target Novell NetWare sites with a service called LANplus. Bell Atlantic also cashed in on the boom in workstations through an agreement with Sun Microsystems Inc. Bell Atlantic people will now serve as Sun field service engineers in the eastern United States. Wallace says both LANplus and the Sun business will be major focuses for Bell Atlantic in 1991.

The company also made some inroads in software last year. In July, Bell Atlantic Software Systems released an enhanced version of its LASER expert systems development environment. And in December 1990, the division announced that it will integrate LASER into IBM's AD/Cycle applications development framework.

Bell Atlantic acquired the Simborg Systems Corp. software company in June 1990. Renamed Bell Atlantic Healthcare Systems, the division markets hospital information systems. In December, this group inked contracts for its StatLAN system with five U.S. hospitals.—*Mark Schlack*

DIEBOLD INC.

818 MULBERRY ROAD
CANTON, OH 44707
(216)-489-4000

RANK 69
IS REVENUE $328.4 M

Counting on Diebold Inc. has become a way of business for many banks that have plugged in the company's automated teller machines (ATMs). Diebold's arsenal of ATMs grew even bigger last year when it teamed up with IBM in a joint venture euphonically dubbed InterBold. InterBold plans to offer self-service banking products ranging from simple cash-dispensing equipment to full-function ATMs that pack the power of 386 engines and can be linked to Token Ring networks.

In the United States, Diebold's main rival is NCR Corp., which matches it for orders every year and has an installed base of roughly 30,000 units. Nevertheless, the InterBold combo, with IBM's installed base, now accounts for 65% of the U.S. ATM market.

Furthermore, the alliance with IBM provides global advantages for Diebold, an attractive situation in view of the uncertainties in the U.S. banking industry.

"The IBM joint venture gives us a huge base of operation outside the U.S.," says Diebold president and chief operating officer Bob Barone. Diebold's numbers reflected its strength overseas last year: IS revenue rose a robust 34.7% in 1990 to $328.4 million.

Barone, who is also CEO of InterBold, expects the U.S. banking business to pick up by the end of this year. He also predicts that InterBold's ATMs will be roaming further afield, moving into more workplaces, fast-food restaurants, resort hotels and casinos. These off-premises machines, he notes, will dispense not only money, but coupons and tickets for transportation and sporting events, as well. On-site ATM action in the near future will take place in bank lobbies, according to Barone, who explains that InterBold is working on a system that will use imaging technology to automate the teller-intensive check-cashing process.

—Linda Runyan

The top 75 North American companies account for 97% of the total North American revenue, the same as in 1989.

ATARI CORP.

1196 BORREGAS AVENUE
SUNNYVALE, CA 94089
(408)-745-2000

RANK 70
IS REVENUE $325.7 M

Atari Corp. has come a long way since its early days of selling Pong video games. Still, several owners and more than 10 years later, the company is struggling to reach the end of a rocky financial road and become a force in the personal computer business. Like many PC makers, it ran into some rough sledding in 1990.

The company's total corporate revenue was down 3% from that of 1989, to $411.5 million. Revenue from personal computer sales dropped 13% to $326 million. Fortunately, the sale of the Federated Group of electronics stores, purchased in 1989, helped offset a $25 million operating loss, resulting in an almost $15 million net earnings gain for the year.

While admitting that 1990's sales and profits were disappointing, chief executive officer Sam Tramiel says the company is looking to new products released in 1990 for a sales boost this year. These include the TT030, a PC based on a 32-megahertz, 32-bit Motorola 68030 microprocessor, and the MEGA STE PC based on the 68000 chip.

Atari is also looking to portable PCs for increased sales. One new product released in 1990 is the Portfolio, a 1-pound, palmtop PC that ships with a Lotus 1-2-3 spreadsheet clone and a word processor for less that $300. It was followed early this year by the Atari STylus, a pen-based system with optical character recognition, and by the more conventional Atari ST, an IBM-compatible notebook PC.

Tramiel cited a shortage of 80386 microprocessors as a reason for the slowdown in sales of the company's Intel-based PCs in 1990. Nevertheless, Atari plans to introduce a new Intel-based line later this year to round out its IBM-compatible offerings.

The company's European sales, which account for a critical 83% of total revenue, continued to soften in 1990. Atari blamed the sluggish sales picture on increasing competition from European computer makers and the general economic slowdown.

—Mike Ricciuti

BOEING COMPUTER SERVICES

2810 160TH AVENUE, S.E.
BELLEVUE, WA 98008
(206)-655-1131

RANK 71
IS REVENUE $320.0 M

The 1990 economic recession that plagued much of the nation bypassed the Pacific Northwest, largely because of The Boeing Co.'s continued strong performance. The showing of its IS subsidiary, Boeing Computer Services, reflected that trend. Overall, the division showed a modest gain, up 11% from $1.5 billion in revenue in 1989 to $1.66 billion last year.

Virtually all of the gain came from the company's main line of business: providing computer and telecommunications services to its parent corporation's healthy defense, space and commercial airline divisions. External sales of Boeing Computer Services's integration services were disappointing. After posting a 31% increase in 1989, the company's outside business declined by about 11% in 1990 to $320 million.

Contracts with the federal government make up the lion's share of the division's external computer business, and that segment accounted for all of last year's drop in business. Boeing Computer Services's government business dropped 16% while outside commercial business rose more than 19%.

Much of the growth in commercial business came when the giant marine transportation company, Nippon Yusen Kaisha, decided to base its computer operations in Seattle and have Boeing Computer Services plan, install and test its new facility.

The Boeing subsidiary has made some efforts to rebound from last year's drop in government business. The company was selected to provide the Naval Weapons Center in China Lake, Calif., with information services under a five-year, $105 million contract. And the U.S. Army Reserve recently chose the firm to compete against Computer Sciences Corp. in a one-year demonstration project for the Reserve Component Automation System. The winner receives a 12-year contract to improve the readiness and mobilization capabilities of the National Guard and Army Reserve.—*Chris Sivula*

EASTMAN KODAK CO.

343 STATE STREET
ROCHESTER, NY 14650
(716)-724-4000

RANK 72
IS REVENUE $320.0 M

Eastman Kodak Co. has seen the promised land of electronic imaging and wants to get there in a hurry. During the past year, Kodak unveiled an awesome array of new products, including scanners, printers, workstations, software, digital copiers and the pioneering Photo CD, a compact disc for storing and displaying photographs on televisions and computer displays.

"We are committed to being the best in imaging, period," says David Giddings, Kodak's vice president and general manager of worldwide imaging information systems marketing.

Kodak has been playing on the periphery of the IS business for years, largely through its computer output microfilm systems, which allow computer data to be printed directly onto microfilm. In the late 1980s, the company introduced the Kodak Information Management System (KIMS), a turnkey system for image management based on Digital Equipment Corp.'s VAX systems. And suddenly Kodak found itself competing head-on with the likes of IBM. "Most companies with an information systems backbone in place didn't want to replace it with a whole new system," explains Giddings. In January of this year, Digital took over the marketing of the KIMS 5000 system, with Kodak supplying the software and peripherals. Kodak still offers the KIMS 4000, which is based on the OS/2 operating system.

It will be years before the Photo CD and other electronic-imaging products begin to make a serious impact on Kodak's bottom line. In 1990, the company's overall revenue inched up just 3% to $18.9 billion. Earnings, at $703 million in 1990, were cut dramatically by the $873.2 million Kodak had to pay Polaroid Corp. in the patent dispute over instant photography. DATAMATION estimates that Kodak's sales of IS products took in about $320 million last year. This figure includes sales from Atex Publishing Systems, the once pioneering, but now moribund, editing and publishing system that Kodak bought in 1981. The figure also includes revenue from Interactive Systems Corp., one of the leading UNIX software houses, and revenue from the sale of printers, which range from the high-speed 1392 laser printer (which Kodak markets through IBM), to desktop ink jet and laser machines. *—Joe Kelly*

CONCURRENT COMPUTER CORP.

106 APPLE STREET
TINTON FALLS, NJ 07724
(201)-758-7000

RANK 73
IS REVENUE $296.0 M

Concurrent Computer Corp. barely stayed afloat last year. The highly leveraged company missed several months' worth of loan payments when the failing Bank of New England shut off the company's access to a $15 million revolving credit line in December. That action, plus the demands of some bond holders, sparked Concurrent's anxious scramble to avoid Chapter 11.

This March, the firm announced a restructuring plan that gave 70% of the company to bond holders but saves the company $55 million in cash over the next two years, says president and chief executive officer Denis R. Brown. That maneuver saved the company from bankruptcy. The debt restructuring plus the September appointment of Brown to the posts of CEO, president and vice chairman calmed anxious users of Concurrent's real-time systems.

"With the new CEO coming in and the debt restructuring, I feel confident that they're making some real improvements in the structure of the company," says John Barris, president of the Concurrent user group Interchange Inc. "I'm feeling a lot better about them surviving through this year and beyond," adds Barris, who is also director of computer systems at Yale University's Wright Nuclear Structure Laboratory.

New CEO Brown, a turnaround specialist, succeeded James K. Sims, who resigned when the company announced losses of $38 million in the second quarter of 1990. Brown blames the financial problems on an overly optimistic growth forecast and a bloated cost structure. When revenue didn't meet projections, he says, the optimistic forecast and the heavy debt load "collided in midair."

The most pressing duties faced by Brown after taking on his new positions in September were to restructure the debt load and reduce costs. He shrunk costs by closing a manufacturing plant in Cork, Ireland; by reducing the work force by about one third (or 900 people); and by consolidating sales and service offices. By now, costs should be diminished by about $70 million, Brown says.

Plans are also in place to sell physical assets, including the corporate headquarters facility (which the company intends to lease back), to help pay off the debt. That debt includes a note for $43 million, due over the next three years, and another $10 million revolving line of credit.

Once again afloat, the firm can turn its attention to product development, such as investigating how best to bring more UNIX-based real-time products to market.

—Elaine L. Appleton

TEKTRONIX INC.

PO BOX 500
14150 SOUTHWEST KARL BRAUN DRIVE
BEAVERTON, OR 97077
(503)-627-7111

RANK 74
IS REVENUE $291.4 M

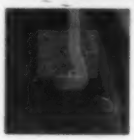
It was a rough year by any measure for Tektronix Inc., the venerable maker of test and measurement equipment that in happier times has also shown strength in computer peripherals and graphics workstations. With sales slipping, board member Robert Lundeen was appointed in April as the company's acting president and chief operating officer.

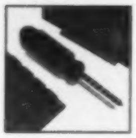
Lundeen took swift action to turn the company around. By the end of the year, some 1,500 positions were eliminated, manufacturing plants were closed in Hoddesdon, England; the Isle of Guernsey; and Vancouver, Wash., and a number of unprofitable peripherals businesses were sold or shut down—including the company's money-losing workstation and semiconductor test systems businesses. Even so, Tektronix remains a force in graphics terminals, printers and plotters.

Analysts generally hailed Tektronix's efforts to restructure its business units. At the same time, most cautioned that getting expenses in line was just half the battle and that the development of new revenue streams was paramount. Returning the company to profitability is now largely up to Jerome J. Meyer, a former vice president of Honeywell, who was appointed president and chief executive officer in November.

There were some revenue gainers in 1990, including high-end digital oscilloscopes and the acquisition of Colorado Data Systems Inc., an Englewood, Colo., maker of test equipment add-in boards for computers. The company also reported increased sales in its color printer unit, a positive response to several new products from its television division and success with its new X terminal family.

New product introductions clearly hold the key to the company's future. A new generation of color printers, due in this summer, should help boost earnings in the near term. For 1991 and beyond, Tektronix's work in flat panel displays looks particularly promising. Tom Long, vice president of technology predicts that most manufacturing challenges





for the flat panel displays will be met within 18 months and that large volume production will begin shortly thereafter. Longer term, he expects other new product breakthroughs based on the company's ongoing superconductor research.—*Paul Pinella*

GERBER SCIENTIFIC INC.

83 GERBER ROAD WEST
SOUTH WINDSOR, CT 06074
(203)-644-1551

RANK 75
IS REVENUE $279.8 M

H. Joseph Gerber started Gerber Scientific Inc. in 1945 when he built a graphical numerical computer called the Gerber variable scale. Today Gerber heads what has grown to be a $300 million organization. The company's 2,400 employees design, make, sell and service Gerber's own line of computer-aided design and computer-aided manufacturing systems used to automate the design and production processes in a dozen industries.

Gerber's five main subsidiaries reflect the variety of businesses it serves. They include Gerber Garment Technology Inc., Gerber Optical Inc., The Gerber Scientific Instrument Co., Gerber Scientific Products Inc. and Gerber Systems Technology Inc. The company also operates subsidiaries in six European countries, as well as in Canada, Mexico and the Far East. Non-U.S. sales accounted for 50% of Gerber's 1990 revenue.

Nearly half of Gerber's sales are from cutting, nesting and material handling systems for the apparel, aerospace, automotive and furniture industries. A second major source of revenue is the firm's microprocessor-controlled production systems for the sign-making and graphic arts industries. Gerber also designs and sells interactive production, drafting and photo-plotting systems, which accounted for 15% of 1990 revenue. Interactive mechanical design, manufacturing and data management systems represented 4% of revenue.

Recessionary pressures in capital equipment spending late last year pushed sales down slightly at Gerber. In the first nine months of the company's fiscal year, which ended April 30, 1991, revenue dropped by 12%, and net earnings plunged 72%. However, unphased by what they describe as a temporary downturn, company planners upped spending on research and development by 2%.

In 1990, David J. Logan, president of Gerber Scientific Products, retired and was succeeded by Ronald B. Webster, the subsidiary's senior vice president and general manager.—*Tom McCusker*

Fifty-nine of the North American companies report IS revenues as 100% of their business.

Call for Entries

AMERICAN MEN AND WOMEN OF SCIENCE, 18th EDITION

Since 1906, American Men and Women of Science has recorded the careers of over 290,000 distinguished scientists and engineers. R. R. Bowker is currently preparing for publication of the 18th edition in January, 1992. This definitive directory includes scientists in 164 disciplines covering the fields of Natural Science, Agriculture, Medicine, Mathematics, Engineering, and Computer Science.

Former entrants are encouraged to update and return their listings as soon as possible to:
R. R. Bowker
Data Collection Center
P. O. Box 2068
Oldsmar, FL 34677-0037

Name ____________________
Address ____________________
____
____
Telephone ____________________
Field ____________________

Please return nomination forms to:
Tanya Hurst
American Men and Women of Science
R. R. Bowker
121 Chanlon Road
New Providence, N. J. 07974

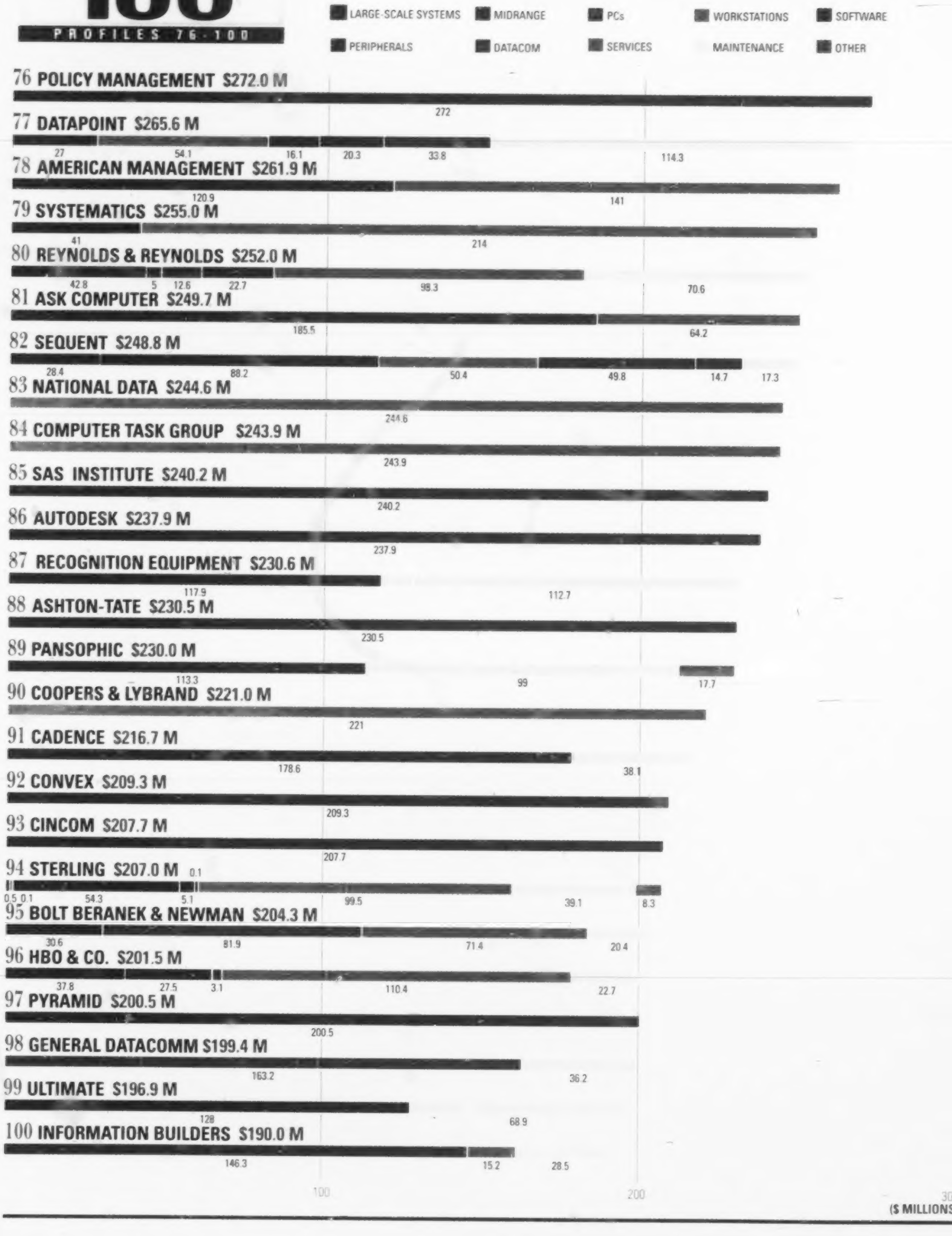
R.R.BOWKER

Entrants who have not yet received an update form should call
1-800-824-2470.

American Men and Women of Science is also seeking nominations from the scientific community for men and women who have not previously been included, but who have distinguished themselves as corporate, government, or academic researchers, policy makers or managers in all fields of science and engineering. Using the form below, please submit names and full addresses of nominees.

THE DATAMATION 100

PROFILES 76-100



POLICY MANAGEMENT SYSTEMS CORP.

P.O. Box 10
Columbia, SC 29202
(803)-735-4000

RANK
76
IS REVENUE
$272.0 M

Policy Management Systems Corp. is one of a number of companies that focus solely on providing highly specialized applications to relatively narrow vertical markets, in this case mainframe applications for insurance companies dealing with property and liability.

The company enjoyed a 30% growth in revenue for a total of $346 million in 1990. That kind of success moved Policy Management into the investment big leagues, as the firm's stock jumped from regional trading to the New York Stock Exchange last year.

In 1989, the cut-off revenue figure for the top 100 North American companies was $142.8 million.

In 1990 it's $190 million.

Policy Management's success is also proving a bit of self-evident wisdom: it can't hurt to have IBM in your corner. Big Blue bought 20% of the company and has signed marketing and product development agreements with it. With the weight of IBM behind it, the firm has launched drives into European markets and into systems for life insurance and health insurance companies.

In 1990, the company purchased PMS Inc., which supplies health insurers with reports on pricing, and Management Data Communications Corp., which provides software and services to group health insurers.

Providing IS services directly to insurance companies is apparently another growing part of Policy Management's revenue stream. Company officials report having signed several major outsourcing clients in 1990, but they are keeping those details secret at the customers' requests.

On the product side, Policy Management is moving toward cooperative processing and strengthening its alliance with IBM. New releases of the company's System 3 software products are compliant with Big Blue's Systems Application Architecture (SAA).

—*Chris Sivula*

DATAPOINT CORP.

8400 Datapoint Drive
San Antonio, TX 78229
(512)-593-7000

RANK
77
IS REVENUE
$265.6 M

Datapoint Corp. continued retrenching in 1990. Revenue dropped more than 11%, hitting $265.6 million, and the company showed a loss of $66.7 million, 48% more than the $45 million it lost in 1989. As has been the case in recent years, most of its business came from overseas, particularly Europe, which contributed 78% of revenue.

Company officials admit that U.S. revenue has declined significantly in the past few years. As a result, Datapoint will be moving to Paris by the middle of 1991. Engineering, support, IS, accounting and manufacturing functions, along with U.S. sales, will remain in San Antonio. The relocation also occasioned a change in management: John Harrison became president when Michael M. Michigami, not wanting to move to Paris, resigned.

Datapoint has had to face the fact that the company and its ARCnet networking protocol may no longer be competitive players in the U.S. networking market. "The way the world is shaking out, there's simply no room for their networking protocol. Ethernet and Token Ring are going to be the dominant protocols," says Douglas Gold, an analyst at International Data Corp. in Framingham, Mass.

But Datapoint continues to develop new products to link existing ARCnet networks with other networking protocols. Recently, the company extended its line of multiprocessor servers for open-systems networks. The Datapoint 7860 dual-processor and the 7960 multiprocessor servers allow users access to a wide area of network services, including Open Systems Interconnect (OSI), IBM's Systems Network Architecture (SNA), Transmission Control Protocol/Internet Protocol (TCP/IP), and Datapoint's own Virtual Circuit System (VCF). The company will offer a version of UNIX System V release 4 for its multiprocessor servers.

By the end of this year's third quarter, Datapoint should have its souped-up, 20-megabit-per-second ARCnetplus on the market. But by then, according to analyst Gold, it may be too late to make a difference, particularly in the U.S. market.—*Bob Francis*

AMERICAN MANAGEMENT SYSTEMS INC.

1777 North Kent Street
Arlington, VA 22209
(703)-841-6000

RANK
78
IS REVENUE
$261.9 M

Telecommunications did the trick for American Management Systems Inc. in 1990, a landmark year for this flourishing systems integrator. Revenue in the telecom arena alone skyrocketed a remarkable 109%, a welcome payoff from partnerships and investments fortuitously made over the past three years. This stellar performance helped AMS gain ground it had lost in 1989, when its federal business was falling and telecom spending was sapping the company's resources.

AMS, which helps IS customers develop new business applications, gets the bulk of its revenue from its telecom and financial sectors. Last year, the financial sector helped out with a hearty 24% boost in revenue. Meanwhile, a slew of lucrative projects doubled the firm's telecom take, which reached $31.5 million. Among these were projects for Rochester Telephone Corp. and Pacific Telecom Inc. AMS also helped Pactel Cellular Services modify its customer service system for Germany and will be involved in a follow-up venture with that firm.

This venture will add fuel to the company's international drive, which started to accelerate significantly in 1990. AMS chairman Charles Rossotti says that the international impetus was felt on both the telecom and financial fronts. "In both areas," he reports, "we started to realize revenues in 1990, especially in our financial industry sector."

Last year, AMS bolstered the domestic side of that sector with contracts from several large banks for the development of consumer loan systems. AMS, Rossotti says, does "business with 40 out of the top 50 U.S. banks, mostly in the consumer area." In an attempt to move further into financial realms, the company took a 10% stake in Advantage KBS Inc., an Edison, N.J., vendor of knowledge-based systems for the insurance industry.—*Linda Runyan*

SYSTEMATICS INC.

4001 RODNEY PARHAM ROAD
LITTLE ROCK, AR 72212
(501)-220-5100

RANK 79
IS REVENUE $255.0 M

Getting together was better than ever in 1990 for Systematics Inc., a facilities management firm that spent most of the eventful year in a manic merger and acquisition mode. The major merger came in May, when $1.6 billion Alltel Corp. took over the 22-year-old outsourcer and gave it an entry into the telecommunications arena. Anxious to establish a beachhead in this new sector, Systematics bought C-TEC Corp.'s Virtuoso software for cellular telephone billing.

Under a separate deal inked in 1990, Systematics will provide C-TEC with data-processing services for its cable television and cellular operations. Systematics derived the majority of its $255 million in IS revenue from such outsourcing contracts, primarily with financial institutions. These contracts contributed to what Systematics classifies as processing revenue, which includes income from systems integration work. This processing pot amounted to $209 million last year, with roughly $5 million coming from consulting and disaster recovery services to banking customers.

Maintenance revenue from the top 100 North American companies grew 12% in 1990.

Approximately 16% of the firm's IS revenue comes from software sales, which hit $41 million last year. To secure its strength on the software and processing sides, Systematics took to the takeover trail. In June, it bought Horizon Software Corp., a developer of software for the IBM AS/400 computer used by midsized financial firms. Four months later, Systematics acquired Computer Dynamics Inc., a provider of remote-processing services for mortgage operations.

Meanwhile, the Alltel merger has already had its advantages for Systematics, which will soon begin handling all of its parent company's data-processing chores. Similar customer contracts are also in the offing. This comes as no surprise to Systematics chairman and chief executive officer John Steuri, who says that even before the Alltel buy-in, "our customers were asking us to not only manage their data processing but also their voice and data networks."—*Linda Runyan*

REYNOLDS AND REYNOLDS CO.

115 SOUTH LUDLOW STREET
DAYTON, OHIO 45402
(513)-443-2000

RANK 80
IS REVENUE $252.0 M

Reynolds and Reynolds Co. depends primarily on the automotive industry for its business, and with an increase in auto dealer bankruptcies in 1990, the firm found itself absorbing more bad debts than usual. IS revenue was down about $1 million in 1990. Now, Reynolds and Reynolds has launched a few new strategies for growth in what is essentially a stagnant market.

Roughly half of Reynolds and Reynolds's 1990 revenue of $595 million came from printing and marketing business forms; $252 million came from IS. Most important to the company's future is how it performs in the United States, which provides about 90% of its revenue. Domestically, the game is one of keeping up with trends.

Shrinking margins on new car sales are driving the auto industry toward larger dealerships, often with multiple locations. At this year's National Auto Dealers Association show in Atlanta, Reynolds and Reynolds introduced an updated version of its ERA dealership system built on NCR Corp.'s Tower machines. ERA integrates business, sales, service and parts applications.

Auto dealers are also trying to compensate for smaller margins through their repair shops. The new ERA system introduced in February tries to ride that trend by integrating with two industry standards—Bell & Howell Co.'s auto parts catalog based on compact disc, read only memory (CD-ROM) and Mitchell International's system for automated body repair estimates.

Augmenting the domestic effort is a push into Europe. In 1987, Reynolds and Reynolds purchased Beri SA, a French systems vendor serving Peugeot SA and Citroen Hispania SA dealers. Although just 7% of Reynolds and Reynolds's IS revenue now comes from Europe, the company expects the unified European market to create new opportunities. As European dealers update their IS technology, Reynolds and Reynolds hopes to capitalize on its 30 years of experience in the United States.—*Chris Sivula*

ASK COMPUTER SYSTEMS INC.

2440 WEST EL CAMINO REAL
MOUNTAIN VIEW, CA 94039
(415)-969-4442

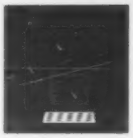
RANK 81
IS REVENUE $249.7 M

With equity financing from Electronic Data Systems Corp. and Hewlett-Packard Co. and with a bank loan from The Chase Manhattan Bank, ASK Computer Systems Inc., last year acquired relational database maker Ingres Corp. for a modest $110 million. The merger sent ASK soaring to nearly $250 million in revenue and beyond its traditional role of supplying manufacturing applications software to industry. ASK, moreover, reached such heights without losing two other important copilots in the company's flight toward factory floor success—Digital Equipment Corp. and IBM.

Few chief executives could have brokered such a transaction besides ASK CEO Sandra L. Kurtzig. Her vision of where her company's manufacturing products had to evolve in the 1990s led ASK down the acquisition path with $40 million from EDS, $20 million from HP and a $50 million loan from Chase. In return, EDS got a 20% stake in the merged company and HP a 10% share.

What resulted was a three-division company whose cumulative 1990 revenue totaled $249.7 million. The Applications Product Division develops and markets Manman manufacturing software for HP and Digital computers, as well as Maxcim and Manman/Process software for Digital computers. The Ingres Products Division offers a wide variety of relational database products and tools. And the Data 3 Products Division creates manufacturing applications, such as SIM/400 for IBM's popular AS/400 midrange system. The Applications and Ingres divisions are roughly equal in size. Combined, they generate about 90% of the new ASK's revenue, with Data 3 contributing the remainder.

Kurtzig got what she wanted from the merger: an engine to drive a high-flying client/server product strategy. At the same time, she was able to accelerate work on ASK's next generation of products—known formally as the Advance series. The new generation of manufacturing software—which will run on all sizes and shapes of systems, not just on select midrange platforms—is late to market. The earliest Advance modules won't get to users until this fall. But Advance could have been delayed even longer had Kurtzig decided to walk away from the failing Ingres and its products—the technologies on which



ASK was building its new manufacturing applications—when the relational database company ran into financial straits last year. "That would have cost us a year because no one had anything close to Ingres's intelligent database," Kurtzig says.—*Tim Mead*

SEQUENT COMPUTER SYSTEMS INC.

15450 SOUTHWEST KOLL PARKWAY
BEAVERTON, OR 97006
(503)-626-5700

RANK 82
IS REVENUE $248.8 M

Since its founding in 1983, Sequent Computer Systems Inc. has ridden a revenue rocket, increasing its revenue by more than 70% each year. Last year, revenue reached $248.8 million, up from $145.6 million in 1989.

But that seven-year spree came to a grinding halt in the first quarter of 1991, when the midrange multiprocessor supercomputer maker experienced its first revenue decline ever—down 5.5% from the level in 1990's first quarter. Like many industry players, Sequent saw sales dry up in part as a result of the U.S. recession. But another factor—an upgrade in January 1991 of its product line—also caused the company's sales to falter, according to Robert Gregg, Sequent's chief financial officer.

Like Sequent's previous computers, dubbed the Symmetry line, the new Symmetry 2000 series of computers employs multiple microprocessors and is targeted primarily at commercial on-line transaction-processing applications (OLTP) that access relational databases. The Symmetry 2000 machines incorporate Intel 80486 microprocessors and offer a threefold speed improvement over Sequent's still available 386-based line.

Because the new series is totally compatible with the old, Sequent didn't expect its introduction to have a serious impact on the sales of the existing line. That proved to be a miscalculation. "The product transition had an effect on our sales force that we weren't prepared for," says Gregg.

Nevertheless, most analysts believe Sequent is well positioned to continue as a mainstream player in the commercial OLTP marketplace. Many vendors are embracing the symmetric-multiprocessing architecture that the company pioneered, and Sequent's long-term experience with its multiprocessing version of the UNIX operating system running on industry-standard Intel chips should continue to serve the company well. Predicts Gregg: "We're convinced that the entire market will be on symmetric-multiprocessing within five years."—*Dwight Davis*

NATIONAL DATA CORP.

1 NATIONAL DATA PLAZA
ATLANTA, GA 30329
(404)-728-2000

RANK 83
IS REVENUE $244.6 M

National Data Corp. felt the pinch in one of the major markets for its electronic financial services—retail sales—last year, and it took a $19.6 million hit for refocusing and consolidating its resources. The firm's 1990 revenue of $244.6 million was down more than 11% from the $275.7 million in 1989.

NDC executives say last year's reorganization has set the stage for future growth. The company consolidated several divisions into one Financial and Information Services Group.

Not affected by the reorganization are the company's major markets for its on-line electronic payment, claims-processing and credit authorization services: banking, retail sales, health care and telecommunications. NDC's electronic payments business did well in 1990. The company acquired five more credit card service accounts last year, adding to the two it held previously. The acquisitions gave NDC a direct relationship with more than 90,000 retailers, most of whom are prospects for other NDC retailer services.

New companies to the North American 100: Western Digital, Software AG, Sequent, Coopers & Lybrand, Pyramid and Information Builders.

NDC introduced a new software system, NDC Nets+Retail, which allows the firm's retailer customers to accept checks and credit cards and to perform cash management functions. Eight industry-specific modules are available with the software. In addition, NDC's two-year-old business of real-time pharmacy claims-processing has grown to almost 10 million claims per month, nearly doubling in 1990, say NDC executives.

The firm does less than 10% of its business overseas but is trying to expand that figure. It opened a software services group in its London office in 1990, and it may be adding other overseas support this year.—*Leila Davis*

COMPUTER TASK GROUP INC.

800 DELAWARE AVENUE
BUFFALO, NY 14209
(716)-882-8000

RANK 84
IS REVENUE $243.9 M

There's probably no better testimony to the benefits of corporate restructuring than the performance of Computer Task Group Inc. in 1990. The company's horizons expanded technologically and geographically, profits reached record heights, and the firm's business opportunities widened considerably. All this came largely as a result of the new foundation that Computer Task Group laid for itself in 1989.

"IBM's investment assured our long-term independence, thereby leading us to examine what we had to be in the 1990s," says CTG chairman David Campbell, referring to the two major events in his company's life in 1989. In June, IBM invested $21 million in the professional IS services company, acquiring a 15% stake. In the fourth quarter of 1989, the company charged $13.6 million against earnings to effect a sweeping consolidation of its U.S. operations. That move eliminated 300 workers.

With Big Blue's bucks and blessing, and lowered operating expenses, CTG set out in 1990 to accomplish what customers and consultants had defined as its strategic mission for the new decade: to evolve into a global firm aimed at helping users apply technology via consulting, systems integration and other services.

CTG struck several tactical targets in 1990 on the way to fulfilling its mission. Most important, its efforts showed up on the bottom line, as net earnings reached $7.2 million on nearly $244 million in revenue. This contrasts sharply with figures from 1989, when the company lost $7.8 million on $233 million in sales. CTG's professional services, which include consulting, document management, database development and a range of other specialties delivered to U.S. customers, yielded $191 million, most of the firm's 1990 revenue. Systems integration services contributed $40 million, and international services chipped in with $13 million.

The company also shot at some new technology targets, via an equity investment in one company and acquisitions of two others. It bought a stake in Image Business Systems Corp., thereby gaining a presence in imaging. The firm also acquired Connolly Data Systems Inc. and its expertise in networking. "That's a good first step in moving the company in the direction of client/server computing," Campbell says of the Connolly purchase, acknowledging that CTG's forte currently lies in mainframe systems. And the company bought Rendeck International of Amsterdam, The Netherlands, an IS professional services firm serving Western Europe that generated $24 million in revenue in 1989.

Carrying CTG's mission successfully through 1991 will be every bit as challenging as in 1990. So far, the company has stood up to the challenge. In the first quarter of 1991, the company increased revenue to $70.7 million, up 20% over figures from the first three months of 1990. This year, CTG also signed a 10-year outsourcing agreement to run the IS operations for Riggs National Corp., a major bank in Washington, D.C.—*Tim Mead*

SAS INSTITUTE INC.

SAS CAMPUS DRIVE
CARY, NC 27513
(919)-677-8000

RANK 85
IS REVENUE $240.2 M

In 1990, SAS Institute Inc. put the finishing touches on a new growth path for the 1990s. Additions and revisions to the SAS Application System, the company's integrated bundle of diverse business applications, were made to take advantage of the distributed multiplatform applications environment that SAS executives believe is coming.

SAS executives call the new version 6.X of the SAS Application System the foundation for convincing customers to install SAS systems management software on multiple platforms from the smallest desktop PCs to the biggest mainframes. As part of that move, SAS also began shipping in 1990 the SAS System for OS/2 and for Sun and Hewlett-Packard UNIX workstations.

The company believes its $240.2 million in revenue posted in 1990—a 16.8% increase over 1989's level—reflects both strong sales of version 6 and stronger sales of additional SAS System products to existing customers. SAS began the year with 60,300 products installed at 17,900 sites worldwide and ended the year with 81,500 products at 20,400 sites.

By the end of 1991, SAS says, it will support every major UNIX vendor, as well as every leading desktop environment, and it has a number of development and marketing alliances to back up these offerings. The SAS System continues its strength in the mainframe and mini markets; by the end of 1990 it was already licensed on 300 of IBM's new ES/9000 mainframes.

For 1991, SAS president James Goodnight plans to steer the company deeper into a few vertical markets where the SAS System has been selling well, including executive information systems (EIS), pharmaceutical and laboratory applications, spreadsheets, 3-D graphics and animation.—*Leila Davis*

AUTODESK INC.

2320 MARINSHIP WAY
SAUSALITO, CA 94965
(415)-332-2344

RANK 86
IS REVENUE $237.9 M

Autodesk Inc. racked up another strong year in 1990, as revenue hit $237.9 million, up 33% from the year before. Even so, the company stumbled slightly for the first time since its AutoCAD drafting package for PCs began to lure buyers in the mid-1980s.

The stumble occurred in the fourth quarter, when Autodesk showed signs that its key product upgrade, AutoCAD release 11, was running into difficulty. Release 11 was then shipping only in the 386 configuration, which accounts for a relatively small share of AutoCAD's installed base. In addition, foreign language versions of the product were delayed, compounding the difficulties.

Although Autodesk managed to get several foreign language versions out the door early this year, and a Sun version hit the streets this April, other key products were pushed back until later into 1991—including the critical MS-DOS version for the 80% of customers still wedded to 80286-based PCs.

Still, one stumble does not a high-tech wreck make. Most estimates hold Autodesk to be the leading vendor of PC-based CAD software, with about 65% of the market. And it's showing signs of success at diversification, including the development of extensions to AutoCAD and a foray into multimedia with Animator, a desktop video package for PCs.

Product extensions to AutoCAD are likely to be more important to Autodesk's immediate future, however. In this arena, Autodesk's Advanced Modeling Extension product for AutoCAD shows the most promise. But, so far, the company is making slow progress in the 3-D modeling area, according to Robert Herwick, workstation analyst at Hambrecht & Quist Inc. "That hasn't hurt them yet because the 3-D modeling market is still small," he notes.

The company has apparently succeeded in another area: integrating the products from its 1989 acquisition of Generic Software Inc. into its own product line. The Generic entry-level CAD package for the PC has staved off a slew of AutoCAD wannabes from biting into Autodesk's market share.—*Bob Francis*

RECOGNITION EQUIPMENT INC.

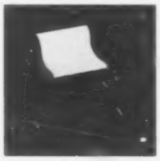
2701 EAST GRAUWYLER ROAD
IRVING, TX 75061
(214)-579-6000

RANK 87
IS REVENUE $230.6 M

Recognition Equipment Inc. took two big steps in 1990 to improve its image—an important move for a company rooted solely in the image-processing business. The 30-year-old company improved its financial footing and finished untangling legal snarls with the world's biggest buyer of imaging products, the U.S. government.

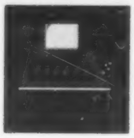
REI achieved financial stability by downsizing. It jettisoned much of its European operations, raising $16 million from the sale of three operating groups in Germany. The company also sold off its Wand Product Division for $8.75 million to the U.S. subsidiary of Siemens-Nixdorf Informationssysteme AG. Meanwhile, the workforce dropped from 2,500 to 1,500.

The downsizing lowered REI's revenue for the year to $230.6 million from $255.9 million in 1989. However, losses also dipped in 1990, down to $32 million compared with $39 million in 1989. For the first quarter of 1991, the company earned $3.7 million on $36 million in sales.



Much of the improvement is attributable to Robert Vanourek and Thomas Hurley, who completed their first full year as the company's co-chief executive officers. The pair arrived at the company in October 1989—a month before a federal judge acquitted the firm and its former CEO of charges relating to the company's efforts to win a U.S. Postal Service contract. A dispute over a currency systems contract between the Federal Reserve Board and REI was resolved on the Vanourek and Hurley watch.

The pair has focused REI on image processing—a direction clearly signaled when it acquired Plexus Computers Inc. in 1989. In addition to marketing its own imaging systems, the company sells Plexus's XPD imaging software through and with eight major U.S. computer companies—including Digital Equipment Corp. and Hewlett-Packard Co.



"We've made good progress," says Tom Frederick, vice president of Recognition Equipment's Software Group, "but we still have a ways to go."—*Linda Runyan*

ASHTON-TATE CORP.

20101 HAMILTON AVENUE
TORRANCE, CA 90509
(213)-329-8000

RANK 88
IS REVENUE $230.5 M

Last year, Ashton-Tate Corp. began putting the brakes on the heavy financial losses it had been racking up.

Last August, the firm finally shipped dBase IV release 1.1, an important upgrade of its mainstay database management system. Since then, over 400,000 copies, including upgrades, have been sold. That's important to Ashton-Tate's economic recovery because dBase generated 74% of the firm's revenue in 1990. Net losses decreased from $28.6 million in 1989 to $18.1 million last year.

Due out this summer is an SQL Server edition for version 1.1, intended for corporate developers and independent software vendors who write dBase applications and require access to mainframe-based relational databases. Ashton-Tate also hopes to deliver the overdue dBase IV version 1.1 Professional Compiler soon. "Our number one priority is the dBase Compiler," says David Proctor, vice president and general manager of the company's database division. Ashton-Tate believes that some dBase users will not upgrade to release 1.1 until the compiler, which is suitable for producing more complex applications, becomes available.

IS revenues of 19 North American 100 companies went down in 1990.

In the legal arena, Ashton-Tate is continuing its copyright violation suit against database competitor Fox Software Inc. and PC-UNIX vendor The Santa Cruz Operation Inc. Last year, a federal judge dismissed Ashton-Tate's lawsuit, but then reversed that decision this past April.

Ashton-Tate will join the graphical user interface bandwagon later this year with dBase IV RunTime Plus for the Mac and a Windows version of Applause, the firm's PC graphics software. But the company says a full Windows version of dBase IV may not appear until the first quarter of 1992.

Shipping dBase for Windows is a high priority to diminish the threat from competing database vendors Fox and Borland International Inc. Both of those companies expect to deliver Windows versions of their database programs in 1991.—*John McMullen*

PANSOPHIC SYSTEMS INC.

2400 CABOT DRIVE
LISLE, IL. 60532
(708)-505-6000

RANK 89
IS REVENUE $230.0 M

This 21-year-old developer of systems software had a tough 1990. A substantial net loss, a corporate reorganization and a layoff were the culmination of diversification decisions the company had made beginning in the mid-1980s that didn't pay off.

Pansophic's venture into the graphics business via the acquisition of Genigraphics Corp. in 1989 started to unravel almost immediately thereafter. Pansophic exited the business in April, resulting in a $14.3 million loss on revenues of $232 million.

"We had gotten dispersed," says David J. Eskra, chairman and chief executive. "The graphics business was losing money, inventory was piling up, and we were trying to sell $75K solutions."

Following the sale of the graphics business assets to Autographix Inc., Pansophic reorganized, forming two major business units. The Systems Software Division represents the consolidation of the company's application development and control products with its information retrieval, connectivity and network management wares. The Application Software Division handles the Pansophic Resource Management System, an integrated financial, manufacturing and distribution application, as well as various separate manufacturing, distribution and financial packages. As a result of the reorganization, the sale of the graphics business and other factors, Pansophic's overall number of employees fell by 229, or about 11%, in 1990, dropping to 1,583.

Pansophic's product lines performed unevenly in 1990. Information retrieval products, such as the Easytrieve line, achieved low double-digit growth rates, says Eskra. But one of the leading products in the applications control area, the Telon applications generator, went off plan.

Nevertheless, Eskra remains positive about 1991, citing the company's strengths in three areas. First is the market for computer-aided software engineering (CASE) tools. Second, its plans to "push code" to the UNIX operating system and to workstation platforms such as, perhaps, the IBM RS/6000. Third is the new CIM Series, an off-the-shelf computer-integrated manufacturing approach that integrates plant floor management activities with manufacturing resource planning (MRPII) systems. "I think the business is there, and we now have the organization to go after it," says Eskra.—*David R. Brousell*

COOPERS & LYBRAND

1251 AVENUE OF THE AMERICAS
NEW YORK, NY 10020
(212)-536-2000

RANK 90
IS REVENUE $221.0 M

When you ask George Van Ness how his company drove IS revenue up over [illegible]9% to $221 million in 1990, the national director of information technology consulting at Coopers & Lybrand cites three factors:

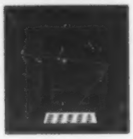
First, the mid-1989 acquisition of Computer Assistance Inc., a Hartford, Conn.-based contract-programming company that complements C&L's mainstay business analysis consulting services with technical assistance for implementing large-system projects.

Second, the maturation of a large-scale system integration development team that has in the last eight years cultivated customers spending $1 million to $10 million with C&L instead of the $50,000 to $100,000 that used to be more the norm at the Big Six accounting firm's smaller scale systems integration contracts.

Third, the introduction of senior level people with large-system expertise into the firm. These managers have brought a strong orientation toward developing reverse-engineering as a major area of consulting for the firm. C&L also maintains working relationships with outside people who lend skills in object technology, expert systems and multimedia.

Underlying this growth has remained a philosophy to "amplify and support the client's internal capability," Van Ness says. That means working with the client's staffers on a project rather than sweeping in, taking over, doing the whole job and leaving. "We're not looking to take over a project, but to split the staff 50-50, and ultimately equip them with the tools to manage on their own."

Coopers & Lybrand has a strong business-consulting presence in such market segments as aerospace & defense, automobiles and pharmaceuticals. In March 1990, C&L formed a new unit called Meritus, in conjunction with



IBM, to provide high-level technical consulting to such industries. This 50-person business unit does the diagnostic work, covering everything from business strategy to requirements analysis for computer-integrated manufacturing. The follow-on integration work is done by C&L and IBM.—*Steve Paul*

CADENCE DESIGN SYSTEMS INC.

555 RIVER OAKS PARKWAY
SAN JOSE, CA 95134
(408)-943-1234

RANK 91
IS REVENUE $216.7 M

Three years after harmonizing their efforts, two Silicon Valley start-ups are in cadence with each other and with the entire electronic design automation (EDA) market. Flowing from the merger of ECDA Inc. and SDA Systems Inc., Cadence Design Systems Inc. scored IS revenues to the tune of $216.7 million last year, almost 50% more than the year before. Roughly $180 million of those revenues came from the sale of EDA software for the design of such basic electronic building blocks as integrated circuits and printed circuit boards.

Cadence's meteoric rise in the EDA industry poses a challenge to its prime competitor, Mentor Graphics Corp., which is also much more profitable than its rival. Cadence chief executive officer Joe Costello has already signaled his intention to wrestle the Mentor muscle by vowing to "become the EDA software leader by 1992."

In 1990, the cocky company took several steps toward that goal. Cadence bought design-tool firm Automated Systems Inc., and it forged a joint development pact with Digital Equipment Corp., which it hopes will ease its EDA wares into the next generation.

That generation gap has to be closed quickly for the company to meet its goal and succeed in the rough-and-tumble systems design market that it plunged into last year. This is where Cadence will feel the full might of Mentor. Arming to take on its adversary, Cadence came out in September with its Amadeus systems design package. Soon, the company hopes to be able to provide links in its systems design software to computer-aided software engineering, mechanical computer-aided design and computer-integrated manufacturing packages. Those links could tie customers to Cadence and its hardware independent approach. Last year, that stance won the company contracts from AT&T Microelectronics and Intel Corp. Cadence also inked an EDA software deal with the European Community's program to build a very large scale integration (VLSI) chip.
—*Linda Runyan*

CONVEX COMPUTER CORP.

3000 WATERVIEW PARKWAY
RICHARDSON, TX 75080
(214)-497-4000

RANK 92
IS REVENUE $209.3 M

Of the pack of start-up companies that established the minisupercomputer market in the mid-1980s, few reached the 1990s intact or unbloodied. One exception is Convex Computer Corp., which racked up sales of $209.3 million in 1990, up 32% from 1989's $158.6 million in revenue. Earnings reached $18.4 million last year, an increase of 57% from those of 1989.

Convex's continuing success can be summed up in the phrase "customer satisfaction," according to Theresa Liu, an industry analyst at Montgomery Securities in San Francisco. The company keeps its accounts happy by offering technically solid computers, sophisticated compilers and system software, and strong support, she says.

Despite the market's continuing perception of Convex as a minisuper supplier, the company has considered itself a true supercomputer vendor ever since the 1988 introduction of its C2 family of machines. The top-of-the-line C2 equals the performance of a Cray XMP computer, says Robert J. Paluck, Convex's chairman, president and chief executive officer.

If any doubts remained about Convex's supercomputer claims, they likely evaporated with the introduction of the firm's C3 line of computers last month. The C3, which had not yet been unveiled at press time, is said to support up to eight processors running at 125 million floating point operations per second (MFLOPS). "The C3 will be our broadest computer family," Paluck says, "and systems will range in price from about $200,000 to as much as $10 million."

The C3 introduction comes at a crucial time for Convex, which in the first quarter of 1991 failed to meet its earnings expectations, breaking a string of 25 consecutive quarters of gains. Analyst Liu attributes the falter to the nation's recession.

Still, Convex has more than 470 customers and has installed more than 800 C1 and C2 machines. Many of these sites will turn to the C3 line for an upgrade path, and Liu says the new line should drive a strong fourth quarter. —*Dwight Davis*

CINCOM SYSTEMS INC.

2300 MONTANA AVENUE
CINCINNATI, OHIO 45211
(513)-662-2300

RANK 93
IS REVENUE $207.7 M

In early 1989, Cincom Systems Inc.'s founder, chairman and owner Tom Nies decided the then 21-year-old software company was starting to get too big for its britches. So, he set his managers to downsizing operations and consolidating the company around three main product groups: database management systems, application development tools, and factory and financial management applications.

As a result, Cincom sold its network management application, NET/MASTER, to Reston, Va.-based Systems Center Inc.—complete with customer base and a sales and support staff of 125 employees.

The sale, which generated some $43 million in one-time revenue for Cincom, "was one of those rare transactions where everyone involved benefits," says Nies.

Cincom has subsequently made strides toward balancing its efforts among the three remaining product groups, announcing enhancements or new items in all three lines. Proof of the success of that strategy lies in the more equalized revenues generated by these groups in 1990. Cincom says database technologies accounted for 33% of revenue last year, down from 42% the previous year. Application development products contributed 27%. Cincom's CONTROL manufacturing applications added another 22%. Other miscellaneous, new products and some holdover NET/MASTER income filled in the remaining 18%.

In 1990, Cincom also started shipping two new computer-aided software engineering (CASE) tools that are compliant with IBM's AD/Cycle automated applications development blueprint. These, the Text Applications Development and the Project Management and Control systems, are the first steps in a strategy to bring the MANTIS application development technology under AD/Cycle. As part of that plan, the company plans to start shipping a fully integrated AD/Cycle tool set—the AD/ADVANTAGE—sometime this year.

Cincom also continued to stress the one technical advantage it offers over the several companies with which it competes in the database, CASE tool and manufacturing applications arenas: hardware and operating system compatibility.

Nies announced last year his intention to develop database and CASE products that included a "Super SAA" capability. By that he meant products that were compliant with IBM's Systems Applications Architecture (SAA) but could also operate in non-IBM environments with little or no modification. Such Cincom products already available run on IBM mainframes, RS/6000 workstations and PCs, as well as on Bull, Digital VAX, Hewlett-Packard and Sun PC platforms.

—J. William Semich

STERLING SOFTWARE INC.

11050 WHITE ROCK ROAD, SUITE 100
RANCHO CORDOVA, CA 95670
(916)-635-5535

RANK
94
IS REVENUE
$207.0 M

Last year was a watershed year for each of the two largest divisions of Sterling Software Inc. The company's Federal Systems Group, which accounted for 43% of overall 1990 revenue, was finally awarded a contested $210 million, five-year National Aeronautics and Space Administration (NASA) contract. Meanwhile, the Systems Software Group, which accounted for 37% of revenue, set three major new strategic initiatives into motion.

These projects include Sterling's Corporate Storage Management Initiative (CSMI),the Corporate Applications Management Initiative and the Corporate Data Communications Initiative. Sterling began delivering products in its Storage Automation Management System, a component of CSMI, in late 1990.

Sterling's fastest growing division, the Electronic Data Interchange (EDI) Group, was created last year and brought in 12% of the firm's 1990 revenue. According to company executives, the enormous growth rate of Sterling's EDI business—a 79% revenue increase in 1990 alone—justified the creation of a separate business group. Part of that growth was fueled by the acquisition of Metro-Mark Integrated Systems Inc. and Lakestone Systems Inc., two EDI companies. The acquisitions position Sterling as the largest provider of EDI software and the second largest provider of EDI services.

The company's Applications Software Group, which specializes in retail and banking software, made up the remaining 8% of the firm's 1990 revenue. Sterling's total revenue in 1990 was $207 million, up from $184.4 million in 1989. Net income for 1990 was $12.4 million, compared with $11 million for 1989.

In 1990, the firm transferred all of its publicly held stock, including common stock, convertible debentures and preferred stock, from the American Stock Exchange to the New York Stock Exchange. The strategy behind the move was to provide more liquidity, access to new capital and more international exposure. Sterling's international markets are growing rapidly, with one-third of the Systems Software Group's business now overseas and the EDI Group expanding quickly abroad. However, because of the large percentage of Sterling's revenue that comes from U.S. federal contracts, only 10% of the company's total 1990 revenue came from overseas.—*Leila Davis*

BOLT BERANEK AND NEWMAN INC.

70 FAWCETT STREET
CAMBRIDGE, MA 02138
(617)-873-2000

RANK
95
IS REVENUE
$204.3 M

It didn't surprise most analysts when revenue at Bolt Beranek and Newman Inc. dropped by some $30 million last year, while net income turned negative by just a tad more than that.

The real surprise about BBN last year was the unexpected strength the company showed in the final quarter of the year. Revenue rose by 9% after two years of weak growth and regular reports of losses. The source of the strength: BBN's advanced networking technologies.

BBN—which earned some $138 million from the DOD last year, or about 53% of its total revenue—is the company that built the Pentagon's Advanced Research Projects Agency Network, or ARPANET, in the 1970s, one of the nation's first high-speed, secure networking systems. BBN continues to build on and enhance that technology both for the DOD and for private users. Last year, communications services and hardware accounted for about $88 million or nearly 34% of BBN's total revenue. The communications division continues to be the company's flagship: in last year's final quarter, communications revenue increased by a hefty 30%.

In general, however, BBN's other divisions showed somewhat less robust increases in the final quarter. Revenue from all services, which include communications services, software services and other activities, and which account for 70% of company business, increased by only 8%. Revenue from products—including the company's own costly initiative into the multiprocessor supercomputer field—rose by 12%. Sales by the BBN Software division—mostly statistical and analysis software running on DEC VAX minis—barely increased at all during that period.

New initiatives announced by the company for this year include shipment of a new T-300 high-speed data communications processor based on BBN's own multiprocessing technology, and product support for GTE Corp.'s Mobile Subscriber Equipment (MSE) program. MSE shipments to GTE this year are expected to rise by some $9 million.

—J. William Semich

HBO & Co.

301 PERIMETER CENTER, NORTH
ATLANTA, GA 30346
(404)-393-6000

RANK
96
IS REVENUE
$201.5 M

Health care is big business. And balancing the demands for high-quality patient care with cost-effective services to maintain market share requires the skills of a surgeon.

Founded in 1974, HBO & Co. (not to be confused with the national cable channel) comprises two independent health care subsidiaries: HBO & Co. of Georgia, which provides minicomputer-based software and services; and HealthQuest Ltd., which provides software and services for users of IBM mainframes. These subsidiaries offer a wide range of patient care, clinical, financial and decision-making software. Revenue for 1990 was $201.5 million, down slightly from $203.6 in 1989.

HBO & Co. of Georgia generates about 75% of corporate revenue primarily from two families of software: the STAR family of integrated financial and clinical applications (running on Data General Corp.'s MV series) and the TRENDSTAR decision support system (running on Digital Equipment Corp.'s MicroVAX). Clients range from small rural hospitals to multifacility urban medical centers.

The HealthQuest subsidiary tends to large, complex health care organizations geared toward IBM platforms, primarily mainframes. (HealthQuest also remarkets IBM equipment to the health care industry.) Its two main product lines, CliniPac and MediPac, offer comprehensive applications for patient care, nursing, pharmacy, patient accounting, management and appointments. HealthQuest's Patient Management system allows the simultaneous management of patient information in both the MediPac and CliniPac systems without redundant data entry or file maintenance.

In 1990, HealthQuest launched a joint venture with IBM Information Network to create QUESTNET. This high-speed nationwide network provides 24-hour support for users of HealthQuest's software and access to a variety of national information databases. Also in the making is a partnership with IBM to develop an image-processing application using ImagePlus.

Last year, HealthQuest introduced QUANTUM, an executive information system that runs on IBM mainframes. Sister subsidiary HBO of Georgia offers the PARAGON EIS system for midrange computers. Both were developed in cooperation with Pilot Executive Software Inc.

President and chief executive officer of HealthQuest Robert Murrie says that "business is focused and healthy" and expects to add 15 new institutions to HealthQuest's customer base in the next year.—*Steve Paul*

PYRAMID TECHNOLOGY CORP.

1295 Charleston Road
Mountain View, CA 94039
(415)-965-7200

RANK 97
IS REVENUE $200.5 M

Customer interest in UNIX and a couple of significant new reseller agreements catapulted Pyramid Technology Corp. to a boom in 1990.

The maker of large UNIX systems based on reduced-instruction set computing (RISC) reported calendar 1990 revenue of $200.5 million, up 75% over 1989. Net earnings more than doubled to $18.36 million.

Pyramid chairman and chief executive officer Richard H. Lussier attributed the company's rapid 1990 growth to a couple of new agreements. The first was a big score with AT&T in the original equipment manufacturer (OEM) arena. Under the accord, AT&T will market Pyramid systems exclusively in some accounts and cooperatively with Pyramid in others. The transformation of AT&T from customer to business partner raised Pyramid's income from AT&T more than 10-fold, from $3.5 million to $37 million in one year. As of the last quarter of 1990, AT&T represented 29% percent of Pyramid's revenue.

Pyramid's other major deal was the acquisition of its Australian distributor from reseller The Lionel Singer Corp. The new Pyramid subsidiary reported a strong year, and Pyramid's Australian revenue grew from $3.5 million in 1989 to $21.6 million in 1990.

Although Pyramid expects to continue garnering strong business from AT&T and end-user markets—especially telecommunications and the Federal government—Lussier cautions that Pyramid is feeling the effects of the recession. Growth rates for the first quarter of 1991 are somewhat lower than they were in the same quarter of 1990. Pyramid is expected to begin shipping a new version of its MIServer UNIX superminicomputer based on Mips Computer Systems Inc.'s RISC processor later this year, but Lussier says strong growth may not return until late this year.

"We think it will be the fourth quarter before we see a return to the kind of growth we saw in 1990," says Lussier.—*Jeff Moad*

GENERAL DATACOMM INC.

1579 Straits Turnpike
Middlebury, CT 06762
(203)-574-1118

RANK 98
IS REVENUE $199.4 M

In the age of networks, it's hard to believe that a company with 22 years of experience in making data communications equipment for the most demanding customers—telephone companies and *Fortune* 500 industrials—didn't grow in 1990. However, such was the fate of General DataComm Inc. last year.

Geography and economics explain why General DataComm's revenue remained flat in 1990. The company relied on North America for 77% of its $199.4 million in revenue in a year that saw most U.S. and Canadian industries suffer a recession. Meanwhile, the European market only contributed 13% of General DataComm's sales. Asia and the rest of the world chipped in the remainder.

However, 1991 and years to come may tell quite a different story for General DataComm. The company is now on much more solid financial ground as a result of trimming costs and raising productivity. Progress in these areas narrowed General DataComm's losses from $7.7 million in 1989 to $345,000 in 1990. More important, the company is displaying a much more aggressive attitude toward developing new products and markets.

Chief among the technologies General DataComm is seeking to exploit in the 1990s is Synchronous Optical Network (Sonet), a standard for transmitting data at speeds of 51.8 megabits per second and faster. The company has added Sonet capabilities to its flagship line of multiplexers, the Megamux TMS family, and to its major network management system, the Megaview Controller. Work on Sonet and other products, such as Mega Bridge, a family of products used to connect local area networks to wide area networks, accounted for much of the $21 million General DataComm spent on research and development in 1990.

One market in which General DataComm clearly wants to widen its presence is Western Europe, where demand for networking products and services continues to be strong, as users lay the groundwork for doing business in the unified arena of 1993. The company has established its first European headquarters, opening an office in Paris to support the efforts of General DataComm's distributors and resellers in the region. One of those distributors remains the Business Communications Group of NV Philips' GL, which markets the Megamux TMS as its high-end Semaplex product.—*Tim Mead*

THE ULTIMATE CORP.

717 Ridgedale Avenue
East Hanover, NJ 07936
(201)-887-9222

RANK 99
IS REVENUE $196.9 M

After a weak 1989, in which The Ultimate Corp. suffered losses approximately equal to the previous year's net income, the company realized that 1990 called for drastic measures.

In May 1990, Ultimate was reorganized into four operating divisions: the Systems Division, which is responsible for systems sales worldwide; the U.S. Customer Service Division, which handles contract service operations; the Professional Services Division, which deals with specialized development software, education and training, direct marketing and consulting; and the Financial Services Division, which takes care of leasing, rental and financial programs.

"With the major restructuring, which was an attempt to cut costs and streamline operations, the company was able to write off $42 million," says James Matthews III, Ultimate's chief financial officer.

In November, Ultimate laid off 175 employees, or 25% of the company's worldwide labor force. The company also reduced senior management salaries by 5% and suspended executive bonus plans.

The good news is that Ultimate's strategy seems to have paid off; the company enjoyed two consecutive profitable quarters since restructuring.

Ultimate is a leading supplier of software, services and systems to the PICK and PICK/UNIX markets. But, like most of the industry, Ultimate has accepted that UNIX will be the open operating system of choice. Now the quest is to position PICK as the database management system for UNIX.

As Ultimate's vice president of engineer-

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MICROMAN II

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ing Steve Sorensen says: "In the past three years, Ultimate has recognized or finally realized that with PICK as an operating system we were fighting upstream against the flow of UNIX. We have been in a major direction shift to coexist as an operating environment with UNIX." The company's ULT/ix and Ultimate Plus products may help bring PICK applications to the UNIX world. —*Sarah Lindsey*

INFORMATION BUILDERS INC.

1250 BROADWAY
NEW YORK, NY 10001
(212)-736-4433

RANK
100
IS REVENUE
$190.0 M

The foundation of the software house that Information Builders Inc. built is Focus, the 15-year-old firm's flagship fourth-generation language. That foundation became even more solid in 1990, resulting in IS revenues of $190 million, 76% of which was attributable to Focus. The product's influence grew even more pervasive last year as it was ported to a number of different platforms.

That porting resulted from partnerships hammered out with hardware vendors the preceding year. Those pacts were hard won, according to Information Builders president and founder Gerald Cohen, who says that prior to 1989, "the hardware vendors ignored us." Thanks to the newfound cooperation, in 1990 Information Builders was able to announce Focus versions for IBM's AS/400, Tandem Computers Inc.'s NonStop and all major Bull HN Information Systems Inc. platforms, including that company's UNIX systems. Information Builders also rolled out UNIX versions for other systems.

The firm furthered its Focnet strategy of tying disparate computers together by moving a number of cross-platform interoperability wares into production. Last year, the company tied connectivity knots between Digital Equipment Corp. and IBM, as well as between IBM and Sun Microsystems Inc. Information Builders also added object-oriented programming might to its Level5 expert system shell.

Still, the focus is on Focus, which, with a user base of some 800,000, dwarfs PC/Focus with 150,000 customers. That mix was evident in 1990, when "the mainframe sector grew faster than any other part of our business," reports Cohen. To grow Focus on foreign shores, Information Builders added Germany to its European operations in preparation for the unified market of 1993.

On the home front, the company launched a value-added reseller program to vault it into vertical markets. Cohen has his eye set on even loftier sites: "Our goal is to have every data center have a copy of Focus," he says.—*Linda Runyan*

Headquarters: 275 Washington St., Newton, MA 02158, (617)-964-3030, telex 127703, fax (617)-558-4506 **Central:** Two Forest Plaza, 12201 Merit Dr., #730, Dallas, TX 75251, (214)-419-1820 **Western:** 12233 W. Olympic, Los Angeles, CA 90064 (213) 826-5818, 3031 Tisch Way, Suite 100, San Jose, CA 95128, (408)-243-8838 **International:** 27 Paul St., London EC2A 4JU, England, (44-1)-628-7030, telex 914911. DATAMATION® (ISSN 0011-6963 GST #123902587) Magazine is issued twice monthly on the 1st and 15th of every month by Cahners Publishing Associates, L.P., 275 Washington St., Newton, MA 02158. Editorial and advertising offices, 275 Washington St., Newton, MA 02158. Annual subscription rates: U.S. and possessions, $69; Canada, $104.86; Japan, Australia, New Zealand, $180 air freight, $290 air mail; Europe $157 air freight, $290 air mail. All other nations, $157 surface, $290 air mail. Reduced rate for U.S. public and school libraries, $47. Single copy, $10 in U.S. **For Foreign Subscribers only:** send all address changes and correspondence to — Datamation, Cahners Publishing Netherlands, Postbus 9000, 2130 DB Hoofddorp, The Netherlands. FAX # ★ 31-20-6531316 Tel # ★ 31-20-6531171. Circulation records are maintained at 44 Cook St., Denver, CO 80206. Phone (303)-388-4511. Second-class postage paid at Denver, CO 80206 and at additional mailing offices. DATAMATION® copyright 1991 by Cahners Publishing Associates, L.P. Reprints of articles are available; contact Andrea Marwitz (708)-635-8800. Microfilm copies of DATAMATION® may be obtained from University Microfilms, a Xerox Company, 300 N. Zeeb Rd., Ann Arbor, MI 48106. Printed by Graftek Press Inc. **All inquiries and requests for change of address should be accompanied by mailing label from latest issue of magazine.** Allow two months for change to be made. **POSTMASTER: send address changes to DATAMATION®, PO Box 173377, Denver, CO 80217-3377.**

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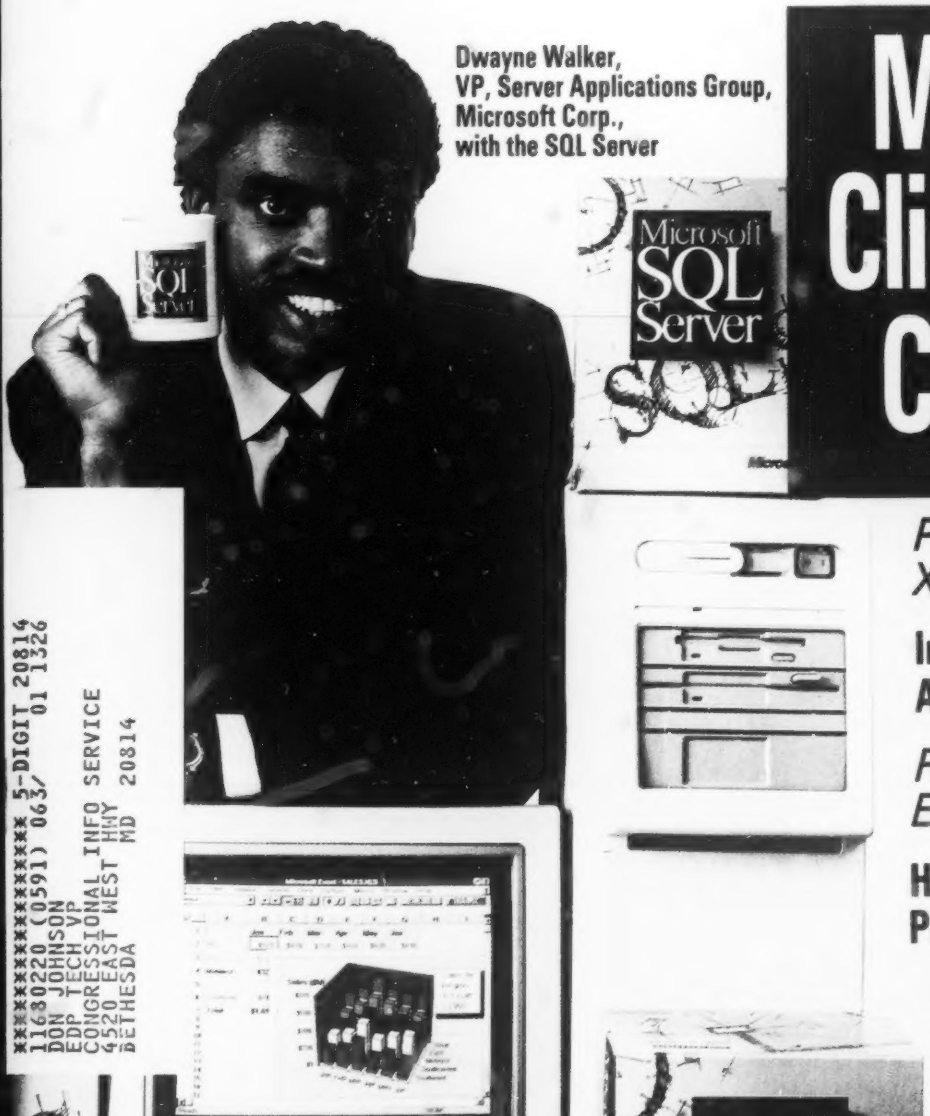
DATAMATION

FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE

JULY 1, 1991



Dwayne Walker,
VP, Server Applications Group,
Microsoft Corp.,
with the SQL Server

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Microsoft's Client/Server Challenger

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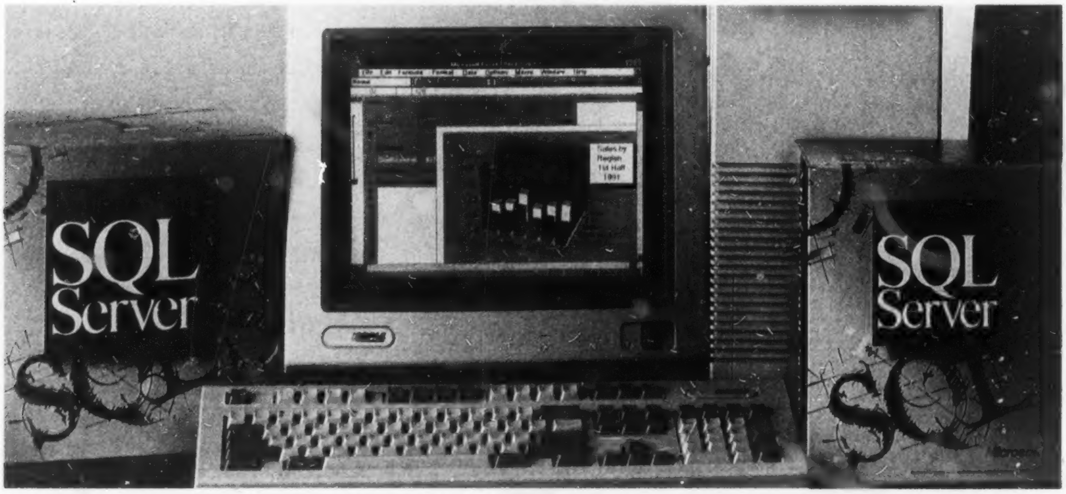
NUMBER 13



SQL Server is attracting attention for its technical strengths and the number of development tools available.

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PCs & WORKSTATIONS

Microsoft's Client/Server Challenger 28

BY JOHN McMULLEN SQL Server, Microsoft's tour de force in client/server technology, is turning heads by enforcing business logic in a new and productive way. But its OS/2 heritage and LAN Manager connections may hinder more than help.

Cover photography by Brian Drake

SPECIAL REPORT

CASE

AD/Cycle Goes Client/Server 34

BY ELIOT D. WEINMAN AND DAN KARA IBM is finally readying its AD/Cycle CASE tool architecture to live in a client/server world. New AD/Cycle partners Easel and Micro Focus may help them pull it off. But where's the repository?

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Windows Development Made BASIC 85

BY MIKE RICCIUTI Programming for Windows is time consuming and tricky. Now Microsoft says it has made writing BASIC Windows applications as easy as using them.

Microsoft's Basker believes programmers should have GUIs too.

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BY JOHN McMULLEN New software is appearing that gives PCs access to both DOS and X Window applications. Initial users seem satisfied, but performance constraints limit this option to occasional UNIX users.

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BY SUSAN KERR New LAN utilities generate a database that not only tells you how many nodes you have but also tells you which CPU chips, network and video cards the nodes have and how much memory is available.

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BY EMILY KAY Looking to connect those old stand-alone order entry, shipping, invoicing and receivables applications? Integrated order entry systems can turn them into a single, automated order management system.

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BY NED SNELL Travel ingredients: good suit, business cards, laptop—and printer? You betcha. The list of lightweight, high-quality portables is growing.

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THE EUROPEAN 25

Ouch! Europe's Big Suppliers Feel The Pinch

BY ELAINE L. APPLETON
Executives from the largest European hardware companies called 1990 the worst year ever, as they struggled with competition from both the East and the West. But flexible, innovative software and service suppliers are thriving. **PAGE 60**

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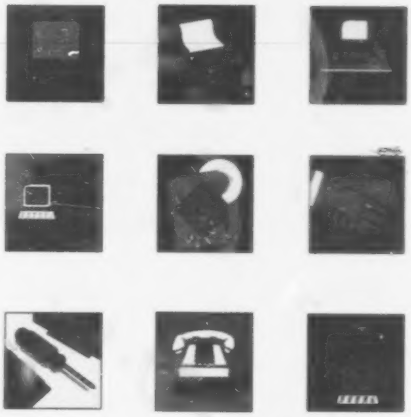

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Ouch! Europe's Biggest Suppliers Feel The Pinch

Executives from the largest European hardware companies called 1990 the worst year ever, as they struggled with competition from both the East and the West. But flexible innovative software and service suppliers are thriving.

BY ELAINE L. APPLETON

In the classic musical Finian's Rainbow, a leprechaun named Og appears periodically wailing, "Gloom and doom, glooooom and dooooom." The leprechaun has lost his pot of gold. And he won't stop wailing until he gets it back.

Og could have been the voice of the European media last year, which repeatedly lamented the bloodletting at Europe's computer makers. Europe's 25 largest information technology suppliers grew almost 10% from $38.0 billion in 1989 to $41.8 billion in 1990, an increase that, at first glance, looks healthy. However, observers sighing over the state of the industry have good reason to be depressed.

The weakness of the dollar (which fell an average 16.3% against the deutsche mark over the course of the year) artificially inflates the figures when they are translated from local currencies. That, in effect, overstates the extent of sales increases and disguises some actual revenue declines of the companies that made DATAMATION's first-ever list of the top 25 European-based IT suppliers. In addition, real revenue gains were often due to acquisitions, as buyers consolidated new subsidiaries' sales into their bottom lines.

Where The Growth Is

The fastest growth in Europe lies in the software and services sectors.

	EUR. RANK	COMPANY	SOFTWARE REVENUE 1990	1989	% CHANGE
1	15	Sema Group	533.4	378.6	40.87%
2	23	SAP	286.0	205.8	39.00%
3	11	Finsiel	525.2	391.5	34.16%
4	2	Olivetti	621.3	497.7	24.82%
5	3	Groupe Bull	635.0	512.9*	23.81%

	EUR. RANK	COMPANY	SERVICES REVENUE 1990	1989	% CHANGE
1	21	GSI	285.2	210.6	35.44%
2	8	Cap Gemini	1465.9	1103.4	32.85%
3	9	Nokia	204.0	160.0	27.49%
4	11	Finsiel	336.0	271.0	23.98%

All revenue figures are in $ millions. * Restated figure.
Siemens-Nixdorf and ICL are not comparable to 1989, due to merger activities in 1990.

Global recession and stepped-up competition from hungry American and Japanese manufacturers assaulted the bottom lines of European IT suppliers last year. Declining orders and faster product cycles that demanded ever-increasing research and development budgets combined to hit vendors where it counts: in the profit margin.

Hard Times In Hardware

Hardware vendors, especially, were hard hit. The top three suppliers on DATAMATION's Eurolist had an excruciatingly bad 1990, as did a number of other box manufacturers. Siemens-Nixdorf Informationssysteme AG (SNI), formed when Siemens AG acquired Nixdorf Computer AG in October 1990, is now the largest European computer maker, with $7.7 billion in revenues. But it hasn't yet made it into the black, and chief executive officer Hans-Dieter Weidig isn't making any promises about when it will. No. 2 Ing. C. Olivetti & Co. SpA capped four straight years of earnings declines with a profit plunge of more than 70% in 1990 to L60.4 billion ($50.8 million). And No. 3 Compagnie des Machines Bull shocked the industry when it lost Fr6.79 billion ($1.25 billion) last year.

Central to the losses suffered by the European 25 was the ailing economic climate throughout much of Europe, which depressed capital investments and, thus, orders for IT products. Sweden and the United Kingdom tottered on the brink of recessions, and growth of the other Scandinavian economies, along with those of France and Italy, also slowed.

Growth in real gross domestic product (GDP) crawled along at 0.5% in 1990 in the United Kingdom and 0.7% in Sweden and 1.4% in Finland, according to UBS Phillips & Drew Ltd., a London-based securities firm. IT investments followed, says Peter Rowell of Regent Associates Ltd., an acquisition broker in London. Real growth in IT was flat in Sweden and Finland, and grew only 6.3% in Britain. Contrast that with Germany, where "there was a tremendous surge in IT business," says Rowell. Germany saw real IT growth of 13%, he reports. But this year should get worse, according to UBS's regional economic forecasts, which don't predict a recovery in Europe until 1992. Even Germany's economy, bolstered by high demand for a variety of products from its eastern half, will slow down this year, predicts UBS.

Threats From The West

Along with regional recessions went the U.S. slowdown, which strengthened U.S. manufacturers' emphasis on selling to Europe. As usual in years past, IBM was the top supplier into Europe. But, last year, Big Blue garnered fully 40% of its revenue there ($26.8 billion), up from 35% in 1989. Similarly, all of Digital Equipment Corp.'s revenue growth came from sales outside the United States, and sales to Europe were up 11.7% to $5.5 billion.

The price discounting that goes with increased competition was tough on European vendors unused to lower profit margins. Comparex Informationssysteme GmbH and Memorex Telex NV, both of which compete directly with IBM, complained publicly that IBM was heavily discounting its products.

Furthermore, European companies couldn't keep up with technology innovation coming from U.S. IT firms, which have the advantage of economies of scale, says UBS Phillips & Drew electronics analyst Adam Quinton. "The Europeans [vendors] have been relatively backward in implementing new technologies. The innovations in PCs, for instance, are only coming from one part of the world, and it certainly isn't Europe."

No European vendor of personal computers could hold its own against the likes of Compaq Computer Corp., Toshiba Corp. and the other Asian clone makers. Even the Houston mail-order house Dell Computer Corp. began to make headway with European customers, which until recently haven't been keen to purchase through the mail. Earnings at Britain's Amstrad PLC, once a top indigenous PC vendor, declined for the second successive year, descending more than £73 million in the last two years alone. Its 1990 earnings tumbled 33% to £34 million ($60.4 million).

In addition, says UBS's Quinton, European vendors "have been slow to adapt their structures to the new realities of open systems. For instance, Norsk Data and Nixdorf [now part of SNI] were stuck in proprietary architectures and were really left behind by events." Says Ninian Eadie, president of International Computers Ltd. (ICL) Europe: "Europe is moving to open systems very

The DATAMATION European 25

	1989 EUROPEAN RANK	1990 WORLD RANK	COMPANY	1990 IS REVENUE	1989 IS REVENUE	% CHANGE	1990 TOTAL REVENUE	IS AS % OF TOTAL REVENUE	NET INCOME
1	--	8	Siemens Nixdorf*	7,735.1	N/A	N/A	7,735.1	100.00%	N/A
2	3	9	Olivetti	6,414.5	5,573.3	15.09%	7,593.7	84.47%	50.8
3	1	10	Groupe Bull	6,349.6	5,128.6	23.81%	6,349.6	100.00%	-1,246.8
4	4	17	NV Philips	3,283.9	2,814.8	16.66%	30,587.6	10.74%	N/A
5	--	20	ICL*	2,862.9	N/A	N/A	2,862.9	100.00%	N/A
6	7	30	Memorex Telex	1,951.2	2,056.6	-5.12%	1,951.2	100.00%	-68.9
7	8	31	Alcatel	1,890.0	1,800.3	4.98%	17,022.0	11.10%	872.0
8	10	37	Cap Gemini	1,684.9	1,103.4	52.70%	1,684.9	100.00%	112.9
9	9	45	Nokia	1,279.9	1,191.9	7.38%	5,788.6	22.11%	71.9
10	11	56	Mannesmann	893.2	819.1	9.04%	1,076.1	83.00%	N/A
11	14	58	Finsiel	861.2	662.5	30.00%	861.2	100.00%	18.7
12	13	63	British Telecom	776.8	692.5	12.18%	21,882.8	3.55%	N/A
13	15	67	Racal	693.0	573.9	20.75%	3,646.5	19.00%	205.7
14	16	70	Comparex	689.4	566.0	21.80%	689.4	100.00%	26.0
15	19	80	Sema Group	533.4	378.6	40.87%	666.8	79.99%	16.9
16	18	81	Sligos	530.7	400.7	32.44%	530.7	100.00%	N/A
17	12	82	Amstrad	518.7	717.0	-27.67%	943.2	54.99%	60.4
18	17	89	SD-Scicon	455.6	434.9	4.76%	455.6	100.00%	-17.2
19	--	102	Hoskyns	396.1	335.0	18.24%	396.1	100.00%	30.7
20	20	105	Norsk Data	383.5	358.1	7.10%	383.5	100.00%	N/A
21	23	107	GSI	375.3	277.1	35.44%	375.3	100.00%	N/A
22	--	110	Dowty	349.9	216.6	61.58%	1,298.4	26.95%	151.0
23	24	112	SAP	340.0	244.6	39.00%	340.0	100.00%	54.7
24	25	121	CGI	289.1	226.8	27.47%	289.1	100.00%	26.4
25	27	125	Reuters	264.7	213.6	23.90%	2,468.9	10.72%	N/A

Revenue figures are in $ millions.

* Siemens Nixdorf and ICL are not comparable to 1989, due to merger activities in 1990.

much more rapidly than America. We don't think it's a minority sport."

Firms supporting fat staffs with the sizable income made on proprietary equipment felt the pinch of skimpier profit margins for items like PCs and UNIX-based systems that look more and more like commodities. In response, staff reductions were widespread. Olivetti has announced plans to lay off 7,000 workers. Scandinavian companies Nokia Data AB and Norsk Data AS together cut 1,100 jobs. Groupe Bull, which reduced its work force by 5,000 in 1990, will have dissolved 8,000 jobs by the end of this year. In total, seven of the top 25 announced plans to cut more than 20,000 IT jobs last year.

So were there any bright spots? There certainly were. As in the States, the victors in the European IT industry were those with solid offerings in software and in services, such as systems integration and facilities management. Companies that support open, networked computing showed particular strength. For instance, SAP AG, a German software company that makes distributed financial, accounting and manufacturing software for use by global customers, grew by 39% to $340 million, and its earnings rose a hefty 20.5% to $54.7 million. Revenues of its infant U.S. subsidiary, SAP America, skyrocketed 250%.

Eying the healthy software and services market, almost every company on DATAMATION's European 25 went roving the Continent and the United States in search of software acquisitions with which to enter the software market or solidify their positions there. Hardware makers, like U.K. modem leader Racal Electronics PLC, are transforming themselves into software and systems integration houses. They desperately need software expertise, which they're finding by mining the wealth at smaller firms. Of the boom in acquisitions, Claus Richter, managing director of Racal-Milgo GmbH, Racal's German subsidiary, says: "It is very, very difficult to find people with the right skills, particularly in Germany. You can retrain, acquire, go into alliances with software houses or take engineers from high school and train them."

The German Factor

Germany was a magnet for acquisition-hungry vendors: Cap Gemini Sogeti, CGI Informatique, Hoskyns Group PLC, ICL, La Générale de Service Informatique (GSI) Sema Group PLC and Sligos all bought software houses or eyed acquisitions in Deutschland. The draw is demand from eastern Germany and the Eastern Bloc. Says Regent's Rowell: "A lot of companies [in the West] were acquiring or partnering with companies in eastern Germany. The first thing they [businesses in eastern Germany] wanted to do was to put in IT systems."

The value of early positioning in Germany didn't escape notice in the States, although the price of European acquisitions for U.S. buyers was high due to the weak dollar. The biggest U.S. acquisition there was Mannesmann Kienzle GmbH's IT business, scooped up by Digital Equipment Corp., which plans a big expansion into the East.

The companies moving into Germany in readiness for an IT explosion in eastern Europe are the early players.

The Top 25 Suppliers Into Europe

									% CHANGE (IN NATIVE CURRENCY)	
1990 RANK	1989 RANK	COMPANY	COUNTRY	1990 EUR. REV.	1989 EUR. REV.	% CHANGE FROM 1989	EUR % OF TOTAL IS	% CHANGE	EUR. IS REV.	TOTAL IS REV.
1	1	IBM	United States	26,836.0	21,281.8	26.10%	40.00%	5.00%		
2	--	Siemens Nixdorf*	Germany	6,961.0	N/A	N/A	90.00%**	N/A		
3	3	Digital	United States	5,490.4	4,915.9	11.68%	42.00%	4.00%		
4	4	Olivetti	Italy	5,324.1	4,514.4	17.94%	83.00%	2.00%	17.9%	15.1%
5	5	Groupe Bull	France	4,508.2	3,231.0	39.53%	71.00%	8.00%	39.5%	23.8%
6	6	Hewlett-Packard	United States	3,534.0	2,886.0	22.45%	38.00%	1.00%		
7	7	Unisys	United States	2,883.6	2,723.1	5.89%	31.00%	2.00%		
8	10	NV Philips	Netherlands	2,495.8	2,054.8	21.46%	76.00%	3.00%	21.5%	16.7%
9	--	ICL*	United Kingdom	2,290.3	N/A	N/A	80.00%	N/A		
10	11	NCR	United States	1,966.0	1,702.1	15.50%	35.00%	3.00%		
11	15	Compaq	United States	1,691.1	1,179.2	43.41%	47.00%	6.00%		
12	13	Apple	United States	1,607.2	1,235.6	30.07%	28.00%	5.00%		
13	17	Cap Gemini	France	1,465.9	893.8	64.01%	87.00%	6.00%	64.0%	52.7%
14	16	Canon	Japan	1,354.1	945.8	43.16%	29.00%	4.00%	43.2%	23.4%
15	12	Alcatel	France	1,341.9	1,476.2	-9.10%	71.00%	-11.00%	-9.1%	5.0%
16	14	Nokia	Finland	1,279.9	1,180.0	8.47%	100.00%	1.00%	8.5%	7.4%
17	18	Xerox	United States	960.0	892.8	9.77%	35.00%	3.00%		
18	23	Finsiel	Italy	861.2	636.0	35.41%	100.00%	4.00%	35.4%	30.0%
19	--	Sun	United States	828.9	515.6	60.75%	30.00%	5.00%		
20	22	Memorex Telex	Netherlands	813.7	664.0	22.55%	41.70%	8.70%	22.5%	-3.0%
21	21	Amdahl	United States	777.2	714.3	8.79%	36.00%	2.00%		
22	19	Wang	United States	756.2	836.1	-9.56%	32.00%	1.00%		
23	25	Commodore	United States	746.8	597.9	24.90%	75.00%	6.00%		
24	--	Comparex	Germany	654.9	566.0	15.71%	95.00%	-5.00%	15.7%	21.8%
25	--	Tandem	United States	618.1	536.6	15.20%	33.00%	1.00%		

Revenue figures are in $ millions.

* Siemens-Nixdorf and ICL are not comparable to 1989, due to merger activities in 1990. ** Percentage based on previous year's information.

THE DATAMATION 100
EUROPEAN 25

Many observers, and several U.S. IT companies, felt last year that the East wasn't yet ready to make IT investments. More basic needs such as food and shelter come first, as does the restructuring of the economy into a healthy capitalist society—a slow, difficult and painful task.

Other intra-European acquisitions, such as Siemens' absorption of Nixdorf, and Dowty Group PLC's purchase of Denmark's Dataco AS, occurred for a more fundamental reason. Large European vendors need critical mass. Greater economies of scale may provide European vendors with the larger R&D budgets they need to compete with American innovators. And these traditionally national champions now see the need to function globally. In particular, the coming unified Common Market presents opportunities for companies large enough to sell, service and distribute across Europe.

Foreign Exchange

Values of foreign currency (equivalent to one dollar) used in this year's DTM 100*.

European Currency Unit	ECU0.7877
Finland	Mk3.823
France	Fr5.446
Italy	L1190
Netherlands	G1.821
Norway	NKr6.258
United Kingdom	£0.563
Germany	DM1.616

*OECD average exchange rates

Threats From The East

The European vendors are scrambling to seize these opportunities before Asian competitors can muscle in. In fact, analysts, along with EC protectionists, suggest that the biggest threat to the continued existence of a European-owned IT industry may be coming from the Far East. NEC Corp. is negotiating to buy a stake in Groupe Bull. Fujitsu Ltd.'s purchase of ICL established a beachhead from which Fujitsu could make further European conquests. In May, ICL announced a plan to take over Finnish Nokia Data, rendering moot staunch assurances from managing director Vittorio Levi that Nokia would remain an independent, European-owned vendor. That's not likely to be the last such acquisition by Japanese IT buyers.

In the face of dire predictions that European-owned IT companies will become anomalies, savvy local executives are examining closely their mix of products and services. Through acquisition of new software products and by purchasing facilities management, consulting, systems- and network-integration expertise, they're attempting to ensure their viability in the new markets emerging in the 90s. And they're looking hard at Eastern Europe, because, from where the Europeans sit, the movement of information technology is clearly to the East. And that may be the only place European IT suppliers will find any pots of gold in 1991.

The DATAMATION European 25 By Technology

	COMPANY	1990 IS REVENUES	MAIN-FRAME	MID-RANGE	PCs	WORK-STATIONS	SOFT-WARE	PERI-PHERALS	DATA-COM	SERVICES	MAINTE-NANCE	OTHER
1	Siemens Nixdorf*	7,735.1	1,018.5	925.9	709.9	154.3	925.9	1,944.4	123.5	277.8	1,654.9	
2	Olivetti	6,414.5	121.8	526.6	1,791.7		621.3	1,113.8	221.4		1,106.6	911.4
3	Groupe Bull	6,349.6	825.4	317.5	1,142.9		635.0	1,333.4		317.5	1,333.4	444.5
4	NV Philips	3,283.9		335.0	576.6		104.3	1,164.2	510.7		472.3	120.8
5	ICL*	2,862.9	392.0	351.3	159.0	103.0	492.0	260.8	76.0	298.0	669.0	61.8
6	Memorex Telex	1,951.2			213.3			1,111.5			401.1	225.3
7	Alcatel	1,890.0			130.0		91.0	781.0	793.8		94.2	
8	Cap Gemini	1,684.9					33.7			1,465.9		33.7
9	Nokia	1,279.9		182.1	304.5	172.9	59.1	32.2	91.0	204.0	148.6	85.5
10	Mannesmann	893.2		312.6				446.6			134.0	
11	Finsiel	861.2					525.2			336.0		
12	British Telecom	776.8							372.9	403.9		
13	Racal	693.0							693.0			
14	Comparex	689.4	249.4					329.2			110.8	0.0
15	Sema Group	533.4					533.4					
16	Sligos	530.7			79.6		53.1			398.0	8.0	
17	Amstrad	518.7			499.1		8.9	10.7				
18	SD-Scicon	455.6				44.4				317.1		94.1
19	Hoskyns	396.1		30.2						365.9		
20	Norsk Data	383.5		212.0			31.2			140.3		
21	GSI	375.3					90.1			285.2		
22	Dowty	349.9							349.9			
23	SAP	340.0					286.0					54.0
24	CGI	289.1					98.3			190.8		
25	Reuters	264.7								264.7		

Revenue figures are in $ millions.
* Siemens Nixdorf and ICL are not comparable to 1989, due to merger activities in 1990.

SIEMENS-NIXDORF INFORMATIONSSYSTEME AG

OTTO-HAHN-RING 6
8000 MUNICH 83
GERMANY

RANK
1
IS REVENUE
$7.74 B

The big question facing Siemens-Nixdorf Informationssysteme AG, formed October 1, 1990 by the merger of Nixdorf Computer AG and Siemens AG's Data and Information Systems Group, is when will it become profitable.

As the largest European-based computer company, SNI started life with DM12.5 billion ($7.7 billion) in revenue and had hoped to run in the black immediately. It didn't. An internal focus on integrating the two companies, marketplace pricing pressures and recessionary forces have caused SNI to announce that it may not reach the break-even point in 1991.

These same factors will directly affect what chief executive Hans-Dieter Weidig calls the key to SNI's success: customer confidence. "No customer is willing to give its nervous system to a partner that is doubtful to survive," he says. "You have to have confidence between customer and supplier."

That confidence has been strained by problems generated by the union: conflicts ranging from disputes over expense forms and costly procedural problems in processing sales orders to the challenges involved in integrating the two product lines. In the first six months after the merger, nearly DM500 billion ($31 billion) in sales went unbilled. Orders also slipped 5%, and recorded billings took a 17% nosedive compared with the performance of the two separate companies in same period of the previous year. All this took its toll: the company lost DM380 million ($235 million) in its first six months.

Nevertheless, there are some signs that SNI is starting to leverage its critical mass. The company reported improved sales and orders for the second quarter of FY1991, which ended March 31, when compared with the first quarter. And in March, SNI booked a record DM1.6 billion ($99 million) in orders.

Still, SNI will have to earn customers' confidence month by month, product by product, as it seeks to stabilize its operations. Judging from the views of one leading customer, Weidig himself is beginning to inspire that confidence. Says Rudiger Brand, chairman of the Europeanwide user group EDV-Anwenderkreis e.V. (EAK), which represents the former Nixdorf user base, "He's very good. He listens to customers." Nevertheless, because SNI's delay in reaching profitability "makes us a little nervous," says Brand, EAK is taking a wait and see attitude before pronouncing the merger a success.

What SNI's users are. waiting to see is how successfully the company's product strategy unfolds. The firm is determined to be a universal supplier of information systems. Grounded in the idea of providing companywide, fully networked computer systems, SNI's product portfolio includes a broad range of equipment and services. It offers AT-based PCs and the 386 SX Micro Channel Architecture PC and plans to add units based on the Extend Industry Standard Architecture (EISA) bus, as well. SNI provides Intel-based workstations and will offer others based on Mips Computer Systems Inc.'s chips. Its UNIX-based Targon and MX midrange systems will support both Intel and Mips microprocessors in a joint product family. SNI caps off its product line with its BS2000 proprietary mainframes.

"We have to be in the business with open systems and mainframes," says Weidig. "Data processing in the '90s will be proprietary mainframes and open systems."

—David R. Brousell

ING. C. OLIVETTI & CO. SPA

VIA G. JERVIS, 77
10015 IVREA, ITALY
(39-125)-525

RANK
2
IS REVENUE
$6.41 B

In February, Vittorio Cassoni, managing director of Ing. C. Olivetti & Co. SpA, told the Italian journal *La Stampa* that "1990 was a terrible year, the most difficult since I've been working in the world of information technology. But we have persevered and guaranteed ourselves the opportunity to compete again in '91."

The numbers bear him out. Last year was the fourth in a row that Olivetti has suffered double-digit declines in net earnings, but it was the first year in which overall revenue remained essentially flat at L9.04 trillion ($7.6 billion). Earnings for 1990, at L60.4 billion ($50.8 million), were down more than 70% in terms of lira from 1989's L202.8 billion ($147.8 million).

Furthermore, says Bruno Lamborghini, vice president of corporate strategic analysis and planning, "We expect '91 will be even more difficult than '90, but we're ready also to start new business."

Olivetti may be ready to proceed, but it must wait and see if the recently reshuffled Italian government carries out promises made by the previous administration. In order to implement plans to cut 3,500 jobs in Italy, the company must wait for the government to pass a new early retirement law.

Luckily, not all of Olivetti's business prospects await decisions from Rome. Lamborghini is looking to the new Olivetti I line of 6.5-pound notebook and 12.1-pound laptop computers, developed and manufactured by the Triumph-Adler division in Germany, to capture 10% of Europe's portable market. Distributed by sales forces from both Olivetti and Digital Equipment Corp., these relatively lightweight units have been well received. Says Dataquest Europe director Philippe de Marcillac: "Olivetti is better placed than it has been in the last two years, with good products in the new laptop and notebook [markets]. The question is, can they deliver them on time and in quantity?"

If Olivetti's performance in laptops equals its experience in banking, which amounts to contracts worth almost L119 billion ($100 million), it should be satisfied. One banking customer, U.K.-based Leeds Permanent Building Society, is replacing all of its old Olivetti equipment with new models after having examined products from several vendors, including IBM. Says George Scarlett, head of the building society's computer services: "Olivetti offered a software platform that was tried and tested for retail banking, and from a price/performance perspective, they were very competitive."

—Marsha W. Johnston

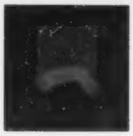
COMPAGNIE DES MACHINES BULL

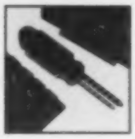
121 AVENUE DE MALAKOFF
75116 PARIS, FRANCE
(33-1)-45-02-90-90

RANK
3
IS REVENUE
$6.35 B

Compagnie des Machines Bull has been struggling for some years. But last year was like no other. Groupe Bull's 1989 net loss of Fr267 million ($41.8 million) exploded to a staggering Fr6.79 billion ($1.25 billion) in 1990. It was, says chairman and chief executive officer Francis Lorentz, "like the ship had been struck broadside by a wave."

Several factors caused the brutal loss, says Jacques Lebhar, executive vice president for finance. First was the decline in sales volume and profit margins experienced by most hardware vendors. Bull incurred high costs in the process of transforming its U.S.-based Zenith Data Systems (ZDS) microcomputer operation from a government supplier into a commercial player. Integrating other acquisi-





tions cost Bull money, too, especially U.S. company Honeywell Federal Systems Inc. (HFSI), which Bull acquired for $93 million in October. And the company set aside Fr3.662 million ($665.1 million) to pay for future restructuring, considerably inflating what would otherwise have been a loss of Fr3.17 billion ($581.7 million).

The decline left Bull weakened, "but she did not capsize," says Lorentz. "And, once she has completed the present tack, she will set off again more quickly and powerfully than before."

That tack has two critical elements, the ambitious restructuring plan, called the Transformation Program, and Bull's new Distributed Computing Model (DCM).

PCs and workstations account for 24.7% of the European 25's revenue. Mainframe and midrange systems account for 13.6%.

Although somewhat late to the open systems market, DCM is critical for users of Bull's proprietary operating system, GCOS, in that DCM will provide some integration with UNIX and DOS-based systems.

As for the two-year restructuring program, Bull intends to cut 8,500 jobs by the end of 1991; it had already cut 5,000 people by early this year. Additionally, it closed seven of its 13 manufacturing plants, reorganized ZDS and formed several technological and geographical alliances in areas where it doesn't have critical mass. It merged operations in most Scandinavian countries with Nokia, Bull's Scandinavian distributor for more than 20 years. And it signed an agreement with Korea's Goldstar Co. Ltd. by which the Korean company will manufacture and market Bull's products throughout Asia.

Were Bull facing these tasks and financial recovery alone, its future would be more questionable, but the French government continues its capital support. It announced its intention to provide Bull with Fr4 billion over the next two years, although at press time it was uncertain whether the European Community would try to block the move.

—Marsha W. Johnston

NV PHILIPS' GL

GROENEWOUDSEWEG 1
5621 BH EINDHOVEN
THE NETHERLANDS
(31-40)-79-1111

RANK
4
IS REVENUE
$3.28 B

Something incredible happened at NV Philips' GL in 1990. In a year when the company lost G4.19 billion ($2.3 billion), cut its work force by 30,000 and changed top management, Philips actually increased its IS revenue.

Philips' IS business came to G5.98 billion ($3.28 billion) last year, which meant only a modest 0.2% increase from 1989's levels in Philips' native currency. But measured in the dollar, which weakened against the guilder during 1990, Philips' IS business expanded 16.7% last year. Philips' overall revenues of G55.69 billion ($30.59 billion) marked a 2.5% decline in guilders in 1990, but a 13% increase [illegible] terms of the dollar.

Apart from a favorable currency swing, the source of Philips' IS growth lies in personal computers and peripherals. PC sales grew a robust 30% to G1.05 billion ($577 million), while peripheral sales were up 23% to G2.11 billion ($1.16 billion).

Philips' strategy for its PCs and other systems is a willingness to combine the company's technology with what other information technology suppliers have to offer. Philips used Microsoft Corp.'s Windows 3.0 graphical user interface as the basis for a desktop document organizer it introduced in 1990.

Another partner in Philips' systems strategy is Sun Microsystems Inc. Using Sun's SPARCstations, Philips' is launching an advanced system for automatic handling of tax returns and insurance policy claims. Aimed at reducing paperwork, the system employs Philips' new case-handling software and its optical document-imaging hardware.

Imaging is clearly one market segment in which Philips sees opportunities. Last year, the company continued to expand its Megadoc family of optical systems.

UNIX-based systems also are high on Philips's agenda—and with good reason. The company's midrange business declined from 5% in 1990, as users turned away from many of the proprietary systems Philips had traditionally marketed. Philips's plan is to strengthen its UNIX base, broadening the number of commercial applications for this standard operating system in key user sectors such as finance and government.

As the company expanded its IS service and software activities around standard platforms throughout 1990, it actually cut back on its IS work force. The number of Philips's IS workers dropped 15% to 14,970 in 1990.

The cost-cutting initiated by the company's new president, Jan D. Timmer, began to pay off early in 1991, when Philips announced modest first-quarter profits of G135 million ($70 million).

—Peggy Salz Trautman

INTERNATIONAL COMPUTERS LTD. PLC

1 HIGH STREET
PUTNEY, LONDON SW15 1SW, U.K.
(44-81)-788-7272

RANK
5
IS REVENUE
$2.86 B

It is hard to imagine how 1990 could have been a more momentous year for International Computers Ltd. PLC.

Its ownership changed from European to Japanese hands in November, when STC PLC sold 80% of the firm to Fujitsu Ltd. Protectionist sentiments flared with the Japanese company's arrival. In March, the board of the Joint European Silicon Submicron Initiative (JESSI) rejected ICL's petition to up its JESSI participation from two projects to five.

Despite a deep recession in the United Kingdom, ICL enjoyed great success with two major new product lines, the DRS 6000 UNIX midrange systems and the series 39 SX mainframes. The company sold 1,000 of the DRS 6000 systems, said to be the first system powered by Sun Microsystems Inc.'s Scalable Processor Architecture (SPARC) reduced instruction set computing (RISC) microprocessor that runs UNIX System V release 4. The UNIX midrange systems garnered significant original equipment manufacturer (OEM) business for ICL, as well. Sun contracted to market the systems in the United States; Acer Inc. will sell them in Taiwan; and Fujitsu will market them in Asia, Australia, North America and Spain. ICL extended the line with an Intel 80486-based deskside version in November.

The new series 39 SX mainframes, including two more models introduced in January of 1991, have been hailed as superb uniprocessors. Although they run ICL's proprietary VME operating system, the company is committed to making them compliant with X/Open Co. Ltd.'s XPG/3 portability guidelines by later this year.

In the past, says David Stewart, chairman of the International Computers Computer Users Association, ICL's customers had to keep the pressure on for new products and product enhancements. "But, with the timeliness and quality of their products in the last three or four years, the need for the user group to put pressure on them to improve products has evaporated," he says.

ICL is aggressively developing its systems integration business, buying companies that enhance its available pool of skills. In October, for instance, it spent £10 million ($17.8 million) for Databolin Information Systems AB, a Swedish supplier of UNIX-based process-manufacturing software.

Despite all of its product and service innovations in 1990, the difficult economic climate worldwide and the U.K. recession kept revenues essentially flat at £1.61 billion ($2.86 billion).—*Marsha W. Johnston*

MEMOREX TELEX NV

HOOGOORDDREEF 9
1101 BA
AMSTERDAM ZO, THE NETHERLANDS
(31-20)-974-331

RANK
6
IS REVENUE
$1.95 B

"The computer industry is in a turmoil. There are two safe positions in the market today: IBM, and niches under the IBM environment." Giorgio Ronchi, the elegant, affable chief executive officer of Memorex Telex NV, made this statement in October 1990. In early 1991, the industry proved him wrong on both counts.

IBM plug-compatible manufacturer (PCM) Memorex Telex NV, better known for reselling than for manufacturing PCM equipment, gets high marks from industry observers for the quality of its sizable international service and support network. But, despite its strengths, orders for its products—terminals, disk drives, tape libraries and the like—slowed in 1990, a weakness the company blames on the Gulf War and the global recession. Memorex Telex lost $68.9 million last year, some 27.1% more than the $54.2 million loss generated in 1989. Overall, 1990 revenue, which the company reports in dollars, came in at $1.95 billion in 1990, down a slight 3% from 1989.

These back-to-back losses are interfering with the peripherals company's ability to service its outstanding debt of $200 million. At press time, the company said it might default on a pending loan payment of some $70 million. When he announced the possible default, Ronchi said the company was evaluating various refinancing and restructuring alternatives. A clue to what he may have in mind is AT&T's 1990 acquisition of just over 6% of the company. Ronchi would like to lure other investors into purchasing similar 5 to 10% equity stakes to help the privately held firm over the hump.

Memorex Telex's biggest weakness last year was it U.S. operation, Memorex Telex Corp., where sales were flat. Previously strong sales of 3270 terminals were eroded by competition from PCs and workstations. Last fall, Ronchi brought in David Faulkner as the new president of U.S. operations to improve North American profits.

Despite the gloomy picture, consultant Bob Djurdjevic of Phoenix-based Annex Research asserts that the company is sound. One piece of evidence: on February 2, 1990, Memorex Telex Japan floated a wildly successful initial public stock offering. Stock prices zoomed from 1,700 to 4,000 yen ($11.74 to ~$27.62) in one day, says Djurdjevic. Asian business contributed 12.4% to revenues last year.—*Elaine L. Appleton*

ALCATEL NV

33 RUE EMERIAU
75015 PARIS, FRANCE
(33-1)-40-58-58-58

RANK
7
IS REVENUE
$1.89 B

Although Alcatel NV ended 1990 in a strong financial position, its growth is slowing. The company, which is nominally headquartered in the Netherlands and uses the European Currency Unit for accounting purposes, reported total revenues of ECU13.4 billion ($17 billion) last year. This 5% increase from 1989 contrasts with the 15% growth the company achieved in 1989. Profits rose 23.7% to ECU591.6 million ($751 million), somewhat shy of the 43% jump the year before. However, the increase was still good news, with 1990 earnings bringing the company's profitability to 5% of total sales, a level that chairman and chief executive officer Pierre Suard did not expect to achieve before 1992.

Alcatel is divided into four main operating divisions. In 1990, its new Network Systems organization, which combines switching and line transmission into a single product group, was put into place. This division generated 37% of the firm's total revenues last year. The Radiocommunications, Space and Defense (RSD) division accounted for 9% of total sales; Business Systems contributed 17%; and Cables came in with 28%. The remaining 9% was generated from other activities such as sales of professional electronics and network engineering. DATAMATION estimates Alcatel's IS revenue at ECU1.49 billion ($1.89 billion), or 11.1% of the company's total income.

Alcatel depended on profits generated by its Cables and Network Systems divisions to compensate for the less than glowing financial performance of its other two divisions. The RSD branch had an operating loss of ECU27.6 million ($35 million) in 1990. The company attributes this showing to RSD's enormous investments in digital cellular networks, especially in systems based on the pan-European Groupe Speciale Mobile standard, which ate up ECU100 million ($127 million), or 22% of the division's 1990 revenues. Similarly, the Business Systems division, feeling pressure from increasing international competition in the European terminal market and having trouble selling Minitels outside France, saw its 1990 operating profits plummet by 63%.

Alcatel's most significant 1990 acquisition was Fiat SpA's Telettra SpA, Italy's leading supplier of telecommunication equipment. Telettra is merging with Alcatel's own Italian subsidiary to form a new company. Under the terms of the the merger, approved in April of 1991 by the European Community, Alcatel will own 75% of that concern, and Fiat will hold the other 25%.—*Jean Magari*

CAP GEMINI SOGETI

11 RUE DE TILSITT
75017 PARIS, FRANCE
(33-1)-47-54-50-00

RANK
8
IS REVENUE
$1.68 B

In 1990, the leading European-owned software and services company brought its list of acquisitions over the past six years to 20.

In July, Cap Gemini killed two strategic birds with one stone when it acquired 69.5% of London-based Hoskyns Group PLC, a company that had been the target of other computer vendors, including Fujitsu Ltd. "We had been looking forever to do something significant in the U.K., and Hoskyns still is number one in the local U.K. [computer services] market," says Michel Berty, Cap Gemini's secretary general. "Also interesting was their ability to do facilities management projects. Years ago, we had announced that we would consider getting into FM as a strategic area, but really hadn't done much since." The company's FM activities had been limited to the small French company, CAP Sesa Exportation, which provided customers with information services personnel but did not act as a systems integrator or provide equipment.

In Germany, Cap Gemini doubled its size with the purchase of Scientific Control Systems GmbH (SCS), the German subsidiary of British software services company SD-Scicon PLC. The acquisition, says Berty, provided Cap Gemini with the systems integration capability it had been looking for.

Cap Gemini also moved into management consulting last year. Parent company Sogeti SA formed the Sogeti Consulting Group by acquiring the research firms Gamma International of Paris and United Research of Morristown, N.J. Early this year, it added another firm, the Mac Group of Cambridge, Mass.

The move into management consulting is designed to give Cap Gemini's software and services operations a competitive edge.

Up to this point, however, Cap Gemini hasn't been handicapped by its previous lack of management consulting. For 1990, it reported a healthy 30% increase in revenue to Fr9.17 billion ($1.68 billion). Net earnings were up 17% to Fr615 million ($112.9 million). Berty attributes Cap Gemini's growth to customers' increasing need for services and expertise, as information technology projects become more complex.

—Marsha W. Johnston

NOKIA DATA AB

P.O. BOX 780 L0-101
HELSINKI, FINLAND
(358-0)-5671

RANK
9
IS REVENUE
$1.28 B

Nokia Data AB, the information technology division of Finnish conglomerate Nokia, took a roller coaster ride last year. The company lost money in Scandinavia, traditionally a profitable market. But in usually troublesome Western Europe, Nokia Data's vertical application solutions for PCs and minicomputers helped the company show a small profit. However, that uptick didn't offset troubles at home: total sales were down 4% to Mk4.9 billion ($1.28 billion).

Nokia Data is highly dependent on Scandinavia. The Finnish market accounts for 40% of the company's sales, and the rest of Scandinavia accounts for another 30%. The remaining 30% comes from Central Europe. In Finland and the other Scandinavian nations, Nokia Data is strong as both a manufacturer and supplier of hardware and software and as an agent for companies such as Compagnie des Machines Bull, Hitachi Ltd., Sun Microsystems Inc. and Tandem Computers Inc.

However, the future does not look especially bright. Competition from European, Japanese and U.S. vendors toughened last year. Following the trend of most PC and mini makers, Nokia Data's margins declined. The company also suffered internal problems. It is still laboring to blend the cultures of the two companies that formed Nokia Data in 1988: the data division of LM Ericsson Telephone Co. and Nokia's own IT operations. Delayed deliveries and products that did not live up to promises hurt the company's reputation. Moreover, Nokia Data reduced its work force by 700 people through retirements and layoffs, which also cut into the company's ability to maintain high-quality service. Nokia Data plans to lay off another 500 workers by the middle of this year.

On top of all this, the Finnish economy has weakened sharply. The banking and financial sectors, which Nokia Data considers its most lucrative vertical markets, have been especially hard hit. Total sales in Finland dropped about 15% last year; in Sweden, sales were down almost 10%.

Following years of speculation that Nokia would be acquired by some other European company or a Japanese firm, ICL of Britain announced at presstime a plan to take over Nokia in a deal worth £230 million ($408.5 million). ICL, which is 80% owned by Japan's Fujitsu Ltd., said it will merge the two companies' IT operations to create a business with total sales of £2.3 billion ($4.9 billion) and employing 24,000.

—Johan Hallsenius

MANNESMANN KIENZLE GMBH

POSTFACH 16 40 7730 AS-VILLIGEN
GERMANY
(49-7721)-671

RANK
10
IS REVENUE
$893.2 M

This is the last year that Mannesmann Kienzle GmbH will appear in the DATAMATION 100 ranking. As of January 1, 1991, the company's information systems businesses were absorbed into a joint venture with U.S. systems giant Digital Equipment Corp. Digital holds 65% ($230 million) of the new venture, called Digital Kienzle Computersysteme GmbH & Co. KG; Mannesmann holds the remaining 35%. Revenues will be consolidated into Digital's sales.

The deal helps to satisfy Digital's increasing need for a strong presence in Europe, particularly in the competitive German marketplace. Mannesmann's computer systems businesses were restructured in 1989, but the German vendor was unable to crack international markets to any significant extent. In addition, the company, which claims an installed base of 25,000 MTOS-based 9000 systems, has been moving away from the proprietary line toward its UNIX-based business systems. This 2000 series was introduced in 1989. Few minicomputer vendors have managed this transition without pain, but Digital Kienzle officials state that demand for the 2000 is growing fast.

The Mannesmann side of the house brings the new 28000 family of UNIX-based workstations to Digital Kienzle. These systems, introduced last year, are based on Mips Computer Systems Inc.'s R2000 and R3000 reduced instruction set computing (RISC) microprocessors. Digital offers workstations based on these chips, as well. Mannesmann Kienzle also introduced new Omega office automation software for customers in the financial and manufacturing arenas.

Digital Kienzle's major goal is to establish an international presence and make inroads into Eastern Germany and throughout Eastern Europe. It also hopes to better target customers in four key areas: finance, administration, retail and manufacturing. Officials from the joint venture have stressed that the company will continue to service its existing customer base.*—Peggy Salz Trautman*

FINSIEL SPA

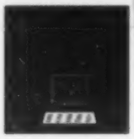
VIA ISONZO, 21/B
00198 ROME, ITALY
(39-6)-84311

RANK
11
IS REVENUE
$861.2 M

No doubt the biggest event of the year for Italy's largest software and services company was the May arrival of new management at Finsiel SpA (Finanziaria per i Sistemi Informativi Elettronici). New administrator Pier Paolo Davoli and president Carlo Tedeschini Lalli have made it clear that they intend to eliminate the perception that Finsiel, which is partially owned by the Italian government, is a lightweight in the private sector.

Davoli, an IBM veteran and former information systems manager with Alitalia-Linee Aeree Italiane SpA wants to expand the company's 11.4% share of the Italian software market. He particularly wants to increase Finsiel's sales to private customers, especially those in banking and finance. To that end, the few months of his tenure have seen the establishment of Binsiel, a consortium with Credito Italiano and Banco di Roma intended to develop advanced banking products and services. It has also seen the acquisition of 60% of Eurosystem, an Italian software house, from the San Paolo of Torino banking group; and the acquisition of Data Management, a software company held by Credito Italiano.

Finsiel's 1990 revenue increased almost 14% to L1.025 trillion ($861.2 million), while



net earnings increased 29%, from 1989's L17.3 billion ($12.6 million) to L22.3 billion ($18.7 million).

In 1990, Finsiel chose to sell through distributors abroad, closing its direct sales office in San Diego. The company, which has almost no business overseas, says it is revising its international strategy. However, officials say Finsiel won't attempt to expand overseas again without a local partner.—*Marsha W. Johnston*

British Telecommunications Plc

BT Center
81 Newgate Street
London EC1 A7AJ, U.K.
(44-71)-356-5000

RANK 12
IS REVENUE $776.8 M

After a year of massive restructuring, British Telecommunication PLC decided on April 1, 1991 to streamline its name, to BT PLC. The new moniker, which does not change the company's legal name, nevertheless underscores the former U.K. telephone monopoly's stated ambition to remake itself into the world's most successful value-added voice and data services company.

Much of BT's efforts during 1990 focused on that restructuring effort, called Project Sovereign. The streamlining effort slimmed down this traditionally over-staffed company by 10,000 people through a combination of voluntary severance and early retirement programs.

The reorganization coincided with a further round of deregulation in the United Kingdom's telecommunications market. Despite fears that it would lose heavily from the November 1990 government proposals to allow more national, regional and local carriers, BT emerged relatively unscathed, except for a moderate cap on the pricing for international calls.

BT is intent on becoming solely a service company, and it has begun unloading its manufacturing concerns. Most notably, it decided to sell back its 51% stake in Canadian telephone switch maker Mitel Corp. BT has already sold off most of its telephone-manufacturing facilities.

The company also announced its long-awaited Global Network Services offering. That service brings together existing value-added voice and data services from its U.K. subsidiary, Dialcom Inc., with the San Jose-based BT Tymnet Inc., the subsidiary it acquired from McDonnell Douglas Corp. late in 1989.

In its most eventful year since it was privatized in 1984, and despite a debilitating economic recession, BT still managed to grow. Revenue increased by 11.9% to $23.5 billion, and earnings jumped 15% to $6.1 billion.

—*Jon Kaye*

Racal Electronics Plc

Western Road
Bracknell, Berkshire
RG12 1RG, U.K.
(44-344)-481-222

RANK 13
IS REVENUE $693.0 M

The breathtaking growth in the mobile telephone business has meant extraordinarily high market valuation for Racal Electronics PLC's subsidiary Racal Telecom PLC. This growth led to a proposal by Racal's directors that Racal Telecom and Racal-Chubb Security Group, a maker of security systems, be spun off from Racal Electronics to maximize their share values. A decision about the proposal will be reached this month.

Racal Telecom and Racal-Chubb, with combined 1990 revenues of just over £1 billion ($1.78 billion), accounted for about half of Racal Electronics's total revenue of £2.05 billion ($3.65 billion). The mobile phone concern in particular has developed an almost autonomous identity, says Mike Styles, electronics analyst with London-based Smith New Court Securities. At press time, for instance, Racal Telecom's share price was £3.80, making Racal Electronics's 80% stake worth more than £3 billion ($5.33 billion)—more than the market capitalization of Racal Electronics as a whole.

Since this situation, which existed in varying degrees for most of 1990, creates a negative market value for the remaining Racal businesses, the directors decided the breakup would be the best way to establish fair market value for all of the businesses.

In the United States, Racal-Milgo purchased Network Communications Group from Digital Communications Associates Inc. for $28 million and entered a joint marketing agreement with MCI Communications Corp. to offer a network solutions package. Racal Data Communications also got a new president, James K. Norman, who committed the firm to providing network solutions rather than just equipment.

Overall, Racal Electronics's IS revenues, which the company reports in dollars, climbed by 20.8% to $693 million. Total operating income increased 30% to 265.1 million ($470.9 million). But net corporate earnings dropped by more than 70%, from £399 million ($652.6 million) to £115.8 million ($205.7 million). The earnings plunge is deceptive: 1989's figures were inflated by a £290.3 million profit made from the sale of 20% of Racal Telecom stock. Factoring that out, the company actually achieved a 6.5% increase in net earnings.

—*Marsha W. Johnston*

Comparex Informationssysteme GmbH

Gottlieb-Daimler-Strasse 10
6800 Mannheim 1, Germany
(49-621)-40090

RANK 14
IS REVENUE $689.4 M

"Taking advantage of high demand in Western Europe and emerging new markets in the East" is how Comparex Informatiossysteme GmbH's chief executive officer Rolf Brillinger accounts for his company's strong showing in a year when other mainframe computer suppliers experienced dwindling profits and weak sales.

Comparex's earnings climbed to DM42 million ($26 million) last year, with sales increasing to DM1.11 billion ($689 million). In terms of the deutsche mark, net earnings rose 17% and revenue increased 4.4% over 1989. However, measuring with the dollar, which weakened against most European currencies in 1990, the company's profits jumped 53%, and revenues rose 22% last year.

In 1990, Germany accounted for 51% of Comparex's revenue. That percentage could increase even more this year, now that the company has established a full sales and services network in the country's eastern territories. The rest of Europe generated 44% of Comparex's sales. The company does only 5% of its business in Asia, and conducts no business in North America.

Comparex's product mix is somewhat more diverse than its geographic complexion. Peripherals contributed 48% of the company's sales. Disk drives and tape cartridge drives were in extraordinarily high demand, Brillinger says, which led to temporary delivery problems and bottlenecks. Comparex's 6388 automatic cartridge library system emerged as the second most popular library system in Europe, after Storage Technology Corp.'s 4400 system. By the end of the year, Comparex had installed 100 of its library systems.

Mainframes accounted for 36% of corporate revenues. Comparex enlarged its mainframe offering in 1990 with the 8/8XX, which already is shipping, and with the

9/9XX, which is scheduled to ship this year. Maintenance and other support services yielded the remaining 16% of the company's revenue.—*Peggy Salz Trautman*

SEMA GROUP PLC

22 LONG ACRE
LONDON WC2E 9LY, U.K.
(44-71)-379-4711

RANK
15
IS REVENUE
$533.4 M

Looking back over Sema Group PLC's business in 1990 and early 1991, chief executive officer Pierre Bonelli delights in giving his favorite example of what he calls the European synergy in this software and services organization. Sema Group SAE, the company's Spanish subsidiary, won a contract to develop software for the 1992 Summer Olympic Games in Barcelona. The contract included programs to manage everything from broadcast scheduling to training to sports equipment control. "Then," Bonelli says, "the British Sema team won the facilities management contract for the Games and will thus operate the systems created by the Spanish Sema Group."

Overall, 1990 revenues grew 28%, reaching £375 million ($666.8 million). But earnings declined by almost 10% to £9.5 million ($16.9 million).

The company, which garners 98% of its revenue in Europe, did best in Germany. Revenue there grew 6%, due to Sema's acquisition early in the year of 50.13% of industrial software maker ADV/Orga F.A. Meyer AG of Wilhelmshaven. Sema spent much of the year trying to regain public confidence in ADV/Orga, which had lost DM14.2 million ($42.5 million) in the fiscal year that ended June 30, 1989. ADV/Orga generated £20 million ($35.5 million) for Sema in 1990, surpassing Sema's predictions by a few million dollars.

Sema just about doubled its 1990 research and development budget to £21.6 million ($38.4 million). Much of that money went to upgrade I-Line, ADV's manufacturing package.

—*Marsha W. Johnston*

SLIGOS

3 PLACE DE LA PYRAMIDE
CEDEX 49
92067 PARIS LA DEFENSE, FRANCE
(33)-1-49-00-90-00

RANK
16
IS REVENUE
$530.7 M

Software and services company Sligos saw another successful year in 1990. Its IS revenue reached Fr2.89 billion ($531 million), up 15% from those of 1989. Net earnings increased 19.6% to Fr160.2 million ($29.4 million) 1990.

A public company since 1986, Sligos is a subsidiary of French bank Crédit Lyonnais and remains strong in banking and related services. Financial services still account for 40% of the company's total revenue, but their contribution to total revenue declined slightly over the past year. Sligos owes its 1990 results to its fast-growing systems-engineering business, which now accounts for 29% of the company's total revenue compared with 22% in 1989. The remainder of Sligos's revenue comes from value-added ser-

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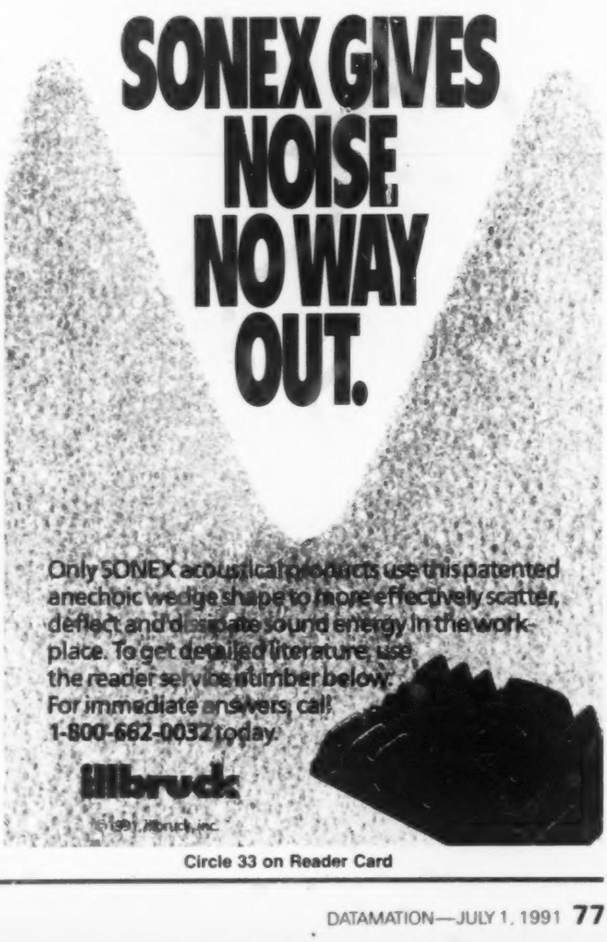
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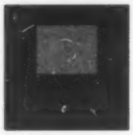

vices and microcomputer sales.

Forecasting revenue of Fr3.5 billion for 1991, Sligos intends to pursue new growth throughout Europe. In addition to acquiring a 60% stake in network specialist Derieux last year, Sligos acquired two French services companies. Sertech specializes in financial services and Maintech is a software reengineering firm. Sligos also took over the Italian industrial systems company Mesarteam and the Spanish financial services company Procesa. These last two acquisitions, along with several contracts signed in Eastern Europe, brought Sligos's revenue outside of France to 11% of total revenue, up from a mere 5% two years ago.—*Jean Magari*

AMSTRAD PLC

BRENTWOOD HOUSE
169 KING'S ROAD
BRENTWOOD, ESSEX CM14 4EF, U.K.
(44-277)-228-888

RANK
17
IS REVENUE
$518.7 M

A new generation of desktop PCs and a foray into the lucrative color laptop market did nothing to stop Amstrad PLC's declining fortunes in the personal computer market.

On its home turf, the company suffered at the hands of Compaq Computer Corp., which is near to overtaking IBM as the number one PC supplier there. And Dell Computer Corp. has blasted away theories that the British would not take to the PC mail-order concept.

Total corporate revenues dropped 16% to £531 million ($943.2 million). The company also announced a second successive decrease in net earnings, from £51 million ($83.4 million) in 1989 to £34 million ($60.4 million).

Amstrad's experience overseas was no more encouraging. In the States, Sears, Roebuck and Co. announced the end of a five-year, nationwide distribution arrangement with Amstrad. In addition, Amstrad scrapped plans to sell through major dealers such as Businessland Inc. and ComputerLand Corp., in favor of increased catalog sales.

Still grappling with its roots as a maker of inexpensive hi-fi systems and home computers, Amstrad made little headway into the business market with its 80X86-based PC1640 and subsequent PC2000 series. Hoping new products would give the company better entrée into the business market, Amstrad unveiled its PC3000 series, based on Intel's 80286, 80386 and 80386SX microprocessors.

Early in 1990, the company launched the ALT laptop line, which includes a color model. The 80X86 line succeeded the aesthetically displeasing 8086-based PPC laptops.

Amstrad is adamant it will maintain its lifelong strategy of selling inexpensive PCs, but the twin pressures of the belt-tightening economy and increased competition, especially in Europe, will be major factors governing performance in 1991.—*Jon Kaye*

SD-SCICON U.K. LTD.

CENTRUM HOUSE
101-103 FLEET ROAD
FLEET, HAMPSHIRE GU13 8NZ, U.K.
(44-252)-622-161

RANK
18
IS REVENUE
$455.6 M

Trouble at home and success abroad was the order of the day for systems integration house, SD-Scicon PLC.

The recession in the United Kingdom and a change in British government procurement policy led to heavy losses in the company's U.K. business last year. Instead of time-and-materials, charge-as-you-go contracts, a change in policy means that government contracts now must be fixed price. But the company wasn't experienced at up-front estimates of fixed price contracts, admits chief executive Philip Swinstead. And inaccurate estimates injured the bottom line. But due to revenue from long-term contracts, it wasn't until last year that the change significantly affected profits.

Company founder Swinstead, unhappy with the U.K. losses, returned as chief executive from his nonactive role as chairman late last year. One of his actions was to bring in new talent to manage the systems integration business. "The people who run [systems integration] are from the electronics-contracting business, not the software business," he says. "So now we know how to negotiate fixed price contracts....Customers always want changes which can eat into profits and put you into a loss quite quickly."

In 1990, SD-Scicon could not avoid a loss of 10% on revenue of £256.5 million ($455.6 million) even by selling two subsidiaries. It ended the year with a loss of net earnings of £9.7 million ($17.2 million). Unprofitable German subsidiary Scientific Control Systems GmbH went to Cap Gemini Sogeti, and Warrington Financial Services, a U.S.-based, on-line bond-trading consulting firm, went to Sungard Data Systems Inc., a U.S. disaster recovery firm.

Of four U.K. business groups—facilities management, application products, systems integration and a consulting firm, the consultancy was the only bright spot in the company's otherwise dismal British scene. It achieved a record £19 million ($31 million) in revenue, a 20% increase over 1989's figures.—*Marsha W. Johnston*

Software and services account for 23.3% of the European 25's revenue. Peripherals account for 20.3%.

HOSKYNS GROUP PLC

HOSKYNS HOUSE
130 SHAFTESBURY AVENUE
LONDON W1V 7DN, U.K.
(44)-71-434-2171

RANK
19
IS REVENUE
$396.1 M

After 13 successive years of growth, topped by a strong 18% increase in revenue in 1990, U.K. services group Hoskyns Group PLC has entered 1991 fearing that its luck may be running out. Worries about the lackluster U.K. economy are compounded by the fact that two major facilities management contracts brought in £20 million ($36 million) less than the company had expected.

"It is difficult to envisage significant revenue growth this year," admits executive chairman Geoff Unwin.

Nineteen-ninety saw massive changes at Hoskyns. In July, French services giant Cap Gemini Sogeti bought a 69.5% controlling interest in the company from Plessey Co. Ltd. The move was Cap Gemini's attempt to acquire a strong foothold in the U.K. services market and to beef up its facilities management expertise.

Hoskyns, meanwhile, was on a buying spree of its own. After acquiring U.K. open systems services firm The Instruction Set in 1989, Hoskyns spent 1990 picking up Germany's TechnoData GmbH, which specializes in construction industry software, and U.K. geographic IS company Conder Technology, a division of construction group Conder PLC.

Most of Hoskyns's business served customers using IBM and Digital Equipment Corp. systems. Only £8 million ($14.2 million) came from contracts based on open systems. Hoskyns is now pushing its open systems approach hard, hoping to hike that revenue in the years ahead. It should have a [illegible] up, as its subsidiary, The Instruction Set, is widely recognized for its open systems expertise. Observers point to this as a likely reason why Cap Gemini looked favorably upon Hoskyns as an acquisition target.

—*Paul Tate*

NORSK DATA AS

OLAF HELSETSVEI 5
P.O. BOX 25, BOGERUD 0621
OSLO 6, NORWAY
(47-2)-62-80-00

RANK
20
'90 REVENUE
$383.5 M

Norsk Data AS is on a downward spiral. In the past two years, the company's losses totaled Kr740 million ($118.2 million). In January of 1991, managing director Erik Engebretsen had to acknowledge that 1990 was another loser. During the second half of the year, business fell faster than expected, and the company wound up with a 1990 loss of Kr129 million ($21 million). If it is any consolation, this is less than a third of the 1989 loss of Kr345 million ($50 million).

Norsk Data needed sales of Kr2.5 billion ($400 million) to break even. But revenues continued their downward slide, falling 4% last year to Kr2.4 billion ($384 million).

Economic slowdowns in two of the company's most important markets, Sweden and the United King-dom, were largely responsible for the slide. Also, profit margins for ND Comtec, a subsidiary specializing in systems for newspapers and the graphics industry, were squeezed, as customers switched from proprietary to standard platforms.

The company did best in Germany and Denmark, where sales of computer-aided design and manufacturing (CAD/CAM) systems grew. But this success could not compensate for the decline in other markets.

In 1990, Dolphin Server Technologies AS, a company partially owned by Norsk Data, introduced the Uniline 88, a network server. Norsk Data also introduced new UNIX-based Wordplex computers, tailored for customers in Britain, and a UNIX-based library system, Bibdia, for the German and Scandinavian markets. Additionally, the company signed agreements to sell Acer Inc.'s personal computers and Data General Corp.'s AViiON workstations.

Norsk Data continued to trim operations in 1990, reducing its work force by 13%, or 400 employees, to 2,600. The company will eliminate another 500 jobs this year, thereby halving the number of employees since the peak in 1987.

In all probability, 1991 will be another tough year for Norsk Data. At the end of 1990, orders on hand totaled Kr190 million ($30.4 million), the smallest backlog since the early 1980s. Furthermore, the company lost a prestigious order for computers from the Norwegian state lottery commission. Until now, the Norwegian government has been one of Norsk Data's most reliable, and lucrative, customers. The loss of the commission's order has caused observers to ask: Why should a customer choose Norsk Data when even the Norwegian government won't?

—*Weje Sandén*

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RANK 21
IS REVENUE $375.3 M

Software and services company la Générale de Service Informatique makes its debut in this year's DATAMATION European 25, following a successful 1990. GSI's revenue just cleared the Fr2 billion mark ($375.3 million) last year, up 15.6% from 1989. Net earnings reached Fr92.8 million ($17 million), an increase of 16.7%.

GSI was founded in 1971 as part of Alcatel NV. It separated from the parent firm in 1987, and in 1990 it paid the final installment of the debt contracted to finance the deal.

GSI provides a range of software and services, including network services and facilities management. The company offers industry-specific software and services for the n[illegible] trade, transportation, tourism, banking and finance sectors, as well as cross-industry software, with applications for payroll and personnel management, business management, and marketing and economics. GSI also has an advanced technology group, which focuses on emerging technologies, such as artificial intelligence and natural languages.

Last year, GSI's products in payroll/personnel management and facilities management, experienced the fastest growth, together accounting for 46% of the company's total revenue. The company also bolstered its motor trade division, which accounts for 12% of total revenue, through two acquisitions. It added the Dutch company Ucoms, which specializes in road transportation management software for IBM AS/400 and UNIX systems, and the German firm Weber and Partner, a supplier of PC software for road cargo management. In all, the number of GSI employees increased by 470 to 3,185.

Two more acquisitions in the payroll and personnel management and motor trade divisions are already lined up for 1991.

—Jean Magari

DOWTY GROUP PLC

ARLE COURT
CHELTENHAM, GLOUCESTERSHIRE
GL51 0TP, U.K.
(44-242)-221133

RANK 22
IS REVENUE $349.9 M

Dowty Group PLC's Dowty Information Technology Division embarked on an aggressive course of acquisitions last year in an effort to become a global player in telecommunications. In so doing, it added depth and breadth to its existing lines of power supply, command and control, and data communications products. It also acquired the staff and partners necessary to reach overseas customers.

Despite the ever-deepening British recession, the division did well. Revenue grew a whopping 49% to £197 million ($350 million), primarily through investments in companies like Danish data communication manufacturer Dataco A/S. But the group as a whole, which includes aerospace products, military electronic systems and polymer engi-

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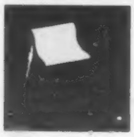


neering businesses, as well as the IT division, grew by only 6.9%, to £731 million ($1.30 billion) in revenue.

Information technology became more important to the Dowty Group in 1990: the IT division contributed 27% of the group's total revenues, up from 19% in 1989.

The acquisition of 60% of Dataco swelled the IT division's ranks from 1,790 at the beginning of 1990 to 2,425 by December. Dowty paid £36 million ($64 million) for the Danish firm, which manufactures local area networks based on the Open System Interconnection protocol. Dataco went on to form an alliance with CASE/Datatel Inc. of Cherry Hill, N.J., another Dowty company, which specializes in multiplexers and X.25 communications equipment. That venture is developing fiber distributed data interface (FDDI) products.

The end of 1990 brought a major organizational shakeup, when CASE/Datatel was renamed Dowty Communications, marking the complete integration of its constituent parts, CASE Communication Inc., Datatel Inc. and Rixon Inc. The newly named company will use its combined strengths in the design and distribution of modems, multiplexers and other data communications products to make an assault on practically the entire communications marketplace in 1991.

The global recession has dampened hopes for the future. This April, the group announced it would reduce its work force by 17% in a cost-cutting measure.—*Glenis Moore*

SAP AG

MAX-PLANCK-STRASSE 8
6909 WALLDORF
GERMANY
(49-6227)-340

RANK
23
IS REVENUE
$340.0 M

With the help of several cooperative efforts and acquisitions, SAP AG (Systeme, Anwendungen und Produkte In Datenverbeitunt) was able to meet its goals for 1990 and build up a stronger international presence. Revenues in 1990, which the company reports in dollars, grew 39% to $340 million. Net earnings grew a substantial 20.5% to $54.7 million. Non-German units were strong performers: SAP International accounted for 42% of the company's revenues. Revenue last year for fledgling SAP America rose more than threefold from its 1989 level.

Together with Siemens-Nixdorf Informationssysteme AG and Robotron-Projekt Dresden GmbH, SAP created the software and system house SRS GmbH of Dresden. SAP owns 45% of that company, which services the eastern German market. In addition, SAP agreed in 1990 to cooperate with the Soviet software house ZPS, based in Twor, U.S.S.R. The goal is to begin development of a Russian version of SAP's R/2 software, the firm's flagship fully integrated business software line.

To better serve its customer base in the West, SAP acquired Steeb and CAS GmbH. As a result, SAP established Steeb-CAS GmbH to concentrate on software for IBM AS/400 minicomputers.

SAP's R&D bill in 1990 accounted for 22% of the company's revenues. The investment, the company says, made three important steps possible. Its ABAP/4, Data Dictionary, Screen Painter and CUA-Painter products became available for R/2 users. The company introduced version 5.0 of R/2 on schedule. And, in the last half of 1991, SAP will unveil the next generation of R/2, dubbed R/3. The new line will extend to more platforms, including UNIX systems and the AS/400. —*Peggy Salz Trautman*

CGI-INFORMATIQUE

34, RUE DU CHÂTEAU DES RENTIERS
F-75640 PARIS, FRANCE
(33-1)-40-77-20-00

RANK
24
IS REVENUE
$289.1 M

CGI-Informatique, which bills itself optimistically as the world's largest computer-aided software engineering company, has been one of the fastest growing IT suppliers in Europe.

Relying on a blend of internal growth and growth by acquisition, CGI's revenues grew a healthy 18.1% in 1990 to Fr1.57 billion ($288.2 million). Net earnings did almost as well, rising 15.4% to Fr1[illegible].4 million ($26.3 million). But growth slowed toward the end of the year, a deceleration CGI blames on the Gulf crisis.

CGI predicts it will accrue revenue of $330 million this year and $460 million in 1992. Analysts believe these figures—along with continued high profitability—are eminently reachable given the company's concentration on markets that have good growth potential and the firm's aggressive, cash-backed acquisition campaign.

In April 1990, CGI bought two major PC products, and their attendant personnel, from Transform Logic Corp. of Scottsdale, Ariz. The products are DesignAid II, which automates the front-end planning, analysis and design phase of the application development life cycle, and Source/RE, a reverse-engineering tool that produces structure charts, complexity analysis and both logic- and job-flow diagrams.

In May, U.S. subsidiary CGI Systems Inc. of Pearl River, N.Y., unveiled PACREVERSE, a reverse-engineering product that enables developers to bring COBOL applications into integrated, repository-based CASE environments.—*Sean Kelly*

REUTERS HOLDINGS PLC

85 FLEET STREET
LONDON EC4P 4AJ, U.K.
(44-71)-250-1122

RANK
25
IS REVENUE
$264.7 M

Reuters Holdings PLC has flourished over the past decade by providing traders, brokers, analysts and others in the financial community with instantaneous information. But now customers want to be able to display that information graphically, analyze it and combine it with their own data. "We need to continue to add value to the data we provide," says David Ure, Reuters's managing director for Europe.

Toward that end, Reuters has been developing platforms for future software-intensive products. The Money 2000 service introduced last year delivers information on foreign currency and money markets in a form that can be more easily manipulated on a workstation. Phase one of Dealing 2000, a trading system unveiled in 1989, works with PC software to let traders simultaneously juggle several deals.

But it's still too early to judge the success of these products. Although sales of Dealing 2000 have exceeded analysts' expectations, the second phase, designed to automate transactions more fully, was delayed because of technical modifications. That setback sent the company's stock plummeting last summer. Doubts were intensified by long negotiations concerning the development of Globex, the off-hours trading system that Reuters is working on with the Chicago Mercantile Exchange and other organizations.

Nevertheless, Reuters's lead position in the industry seems unassailable. Peter Job, who took over as chief executive officer in March of 1991 from Glen Renfrew, points out that incremental improvements on the company's mainline products are more important than fancy new projects.

Financially, last year was a hit: pretax profits rose 13.1% on revenues of £1.37 billion ($2.43 billion), up 15.3% from £1.187 billion ($1.94 billion) the year before. With a horde of cash, the company is braced for a long downturn. —*Fred Guter*

NEW PRODUCTS

A SELECTION OF RECENT INTRODUCTIONS

DATAMATION'S PRODUCT REVIEW

PCs & WORKSTATIONS

IBM Goes Hollywood

Hollywood is IBM's contribution to the Windows-based presentation graphics market.

The software comes with an integrated outliner that organizes a presentation, checks spelling and creates bulleted lists or organizational charts. A data manager function allows users to import data from spreadsheets and establish links; charts are automatically updated when the source data changes. Hollywood also provides predesigned templates and color schemes for presentation slides, paint and draw tools, and a communications program for producing.

Hollywood requires at least a 286-based machine with 1.6 megabytes of random access memory (RAM) and a hard disk (IBM recommends a 386 with 2MB RAM), DOS version 3.3 or later, and Microsoft Windows 3.0. Hollywood is priced at $495. IBM, White Plains, N.Y.

Circle 520

Color On The Go

The T3200SXC, Toshiba America Information Systems Inc.'s first color portable PC, is designed for people who need color on the road. The machine is designed for slide shows, animated graphics or full-motion video.

The VGA-compatible, liquid-crystal display can present 256 colors simultaneously from a palette of more than 185,000. The display uses thin-film transistor, liquid-crystal display (TFT-LCD) technology.

Weighing in at 17 pounds, the T3200SXC features a 20-megahertz 80386SX processor. The $8,999 portable comes with 1 megabyte of memory, expandable to 13MB; one full-size and one half-size expansion slot; a dedicated slot for a Toshiba modem; a 120MB hard disk; and a 1.44MB, 3.5-inch floppy drive. TOSHIBA AMERICA INFORMATION SYSTEMS INC., Irvine, Calif.

Circle 521

Take A RISC On X Terminals

Hewlett-Packard Co. recently rolled out a four-member family of reduced instruction set computing (RISC)-based X terminals. HP says the machines deliver two to four times the performance of competitive X terminals, a claim based on the Xstone and x11perf public domain benchmarks for measuring X Window System server products.

HEWLETT-PACKARD'S 700/RX FAMILY of X terminals are based on RISC processors.

Based on Intel's i960 superscalar microprocessor, the HP 700/RX family is designed for geographic information systems, mechanical computer-aided design (MCAD), desktop publishing, business graphics, and office and manufacturing automation.

The 22.7-megahertz models, 19Ca and 16Ca, feature eight-plane color graphics and have 4 megabytes of memory. They boast 75,000 Xstones of performance and have an overall x11perf rating of 0.85. The 20MHZ models, 19Mi and 16Ci, offer 2MB and 4MB of memory, respectively. Each machine's memory can be expanded to 18MB. The 19Mi has a monochrome display; the other three are color models that can display 256 colors from a total palette of 16.7 million. Prices range from $2,995 to $5,995. HEWLETT-PACKARD CO., Palo Alto.

Circle 522

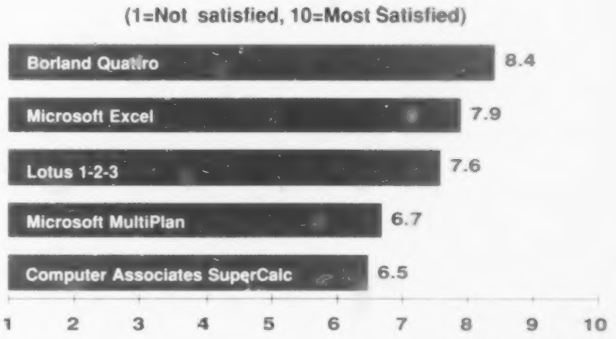
SOFTWARE

Ingres For A/UX Macs

Ingres now runs on yet another platform—Macintoshes running the A/UX operating system. Ingres For A/UX 2.0 includes the Ingres relational database management system (RDBMS), fourth-generation language (4GL) application

IS Satisfaction Scorecard: Spreadsheets

Are IS managers satisfied with their spreadsheets? DATAMATION surveyed IS managers who have purchased microcomputer spreadsheets to determine their level of satisfaction. Their responses indicate that Excel and Quattro owners are more satisfied with their choice than 1-2-3 owners.



Source: DATAMATION Brand Preference Study

MARKET INSIGHTS

AN ANALYSIS OF ECONOMIC TRENDS

Bye-Bye Recession, Recession Bye-Bye

BY MADELINE FRANCHI
Cahners Economics

Dare we say it? We do! The recession for the IS industry is on its way out, and a mild recovery is on its way in. How do we know? The DATAMATION Information Systems Performance Indicator (ISPI), our exclusive gauge that tracks changes in the health of the IS industry, turned the corner in February. It rose for the first time in nearly a year, to 95.94 after a low of 94.89 in January. And looking at March data—with an advance reading of 96.47—plus some early readings for April, we can say with reasonable confidence that this upswing has legs.

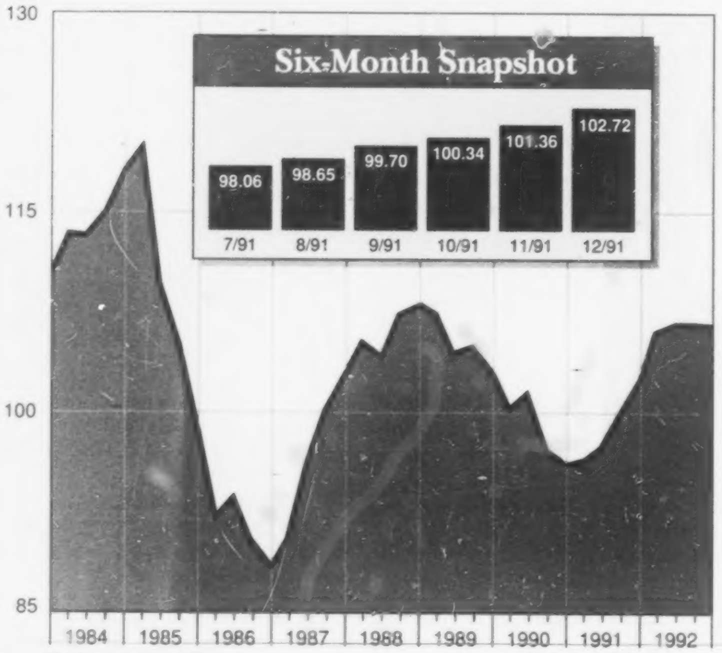
But when will those legs get moving at full tilt? Not soon. The industry won't really get back up to speed until October or November, which is when we expect the indicator to finally rise above the 100 mark. A value above 100 means the industry's performance in the three preceding months exceeded its performance in the same three-month period of the previous year. (So, if the mark rises above 100 in October, it will mean that the industry performed better in August, September and October 1991 than it did in the August-through-October period of 1990). After it breaks the 100 mark, we are forecasting that it will continue to rise, but nowhere near the rate at which it did in the double-digit 1980s.

Overall, we expect this recovery to be mild for the IS industry; the ISPI will most likely stay below the 110 mark despite the coming turnaround. Some industry-specific statistics on the IS industry continued to fall in March. But the rate of decline for these sectors has slowed significantly in recent months. At any rate, if you're looking for a model of this year's turnaround, you'd be well served to look back to 1988—one of the slowest and briefest turnarounds on record. ▭

For more information on Cahners Economics's forecasting services, including seminars, newsletters and database diskettes, call Dan Buchan at (617)-630-2105, fax him at (617)-630-2100 or write to him at Cahners Economics, 275 Washington St., Newton, MA 02158.

The IS Performance Indicator

Our forecast of improvement is fast proving true.



Shaded area denotes forecast

Source: Cahners Economics

	March 1990	Feb. 1990	% Change 2/90-3/90	March 1989	% Change 1989/1990
■ **Information-Processing Equipment**					
Shipments (SA. $ billions)	9.28	9.36	-0.9	9.35	-0.8
New Orders (SA. $ billions)	8.93	9.79	-8.8	9.45	-5.4
Unfilled Orders (SA. $ billions)	28.60	28.95	-1.2	27.16	5.3
Inventory (SA. $ billions)	16.03	16.11	-0.5	17.22	-6.9
■ **Computer Production Workers**					
Employment (NSA. thousands)	265.3	265.2	0.0	280.6	-5.5
Average Weekly Hours (monthly avg.)	40.0	41.1	-2.7	41.6	-3.8
■ **Stock Index**					
S&P's Computer Systems Stock Price Index	187.9	201.8	-6.9	181.6	3.5
■ **Contracts & Orders**					
New Plant & Equipment (SA. $ billions)	41.0	41.9	-2.1	41.1	-0.3

SA = seasonally adjusted
NSA = not seasonally adjusted

Source: U.S. Commerce Dept., Standard & Poor's forecasts: Cahners Economics

NOTE: The U.S. Commerce Department revised all historical data on shipments, orders, inventory and unfilled orders. Therefore, you will notice revisions in the IS PI compared with previous issues of this magazine.

MARKET INSIGHTS

A SURVEY OF TECHNOLOGY TRENDS

It's A WANderful Life

BY WARREN CHILDS
Business Research Group

In the latest survey of the DATAMATION Technology Panel, some 51% of the sites surveyed said they use wide area networks to link personal computer-based local area networks. Such LAN-to-LAN communication currently represents only a fraction of the total data and voice communications traffic on public networks. But transmission carriers are making major investments to improve WAN technology, believing that WANs will become the standard method of networking in the future. Most have been busy developing and deploying a number of new services to meet the demands of this fast-growing market.

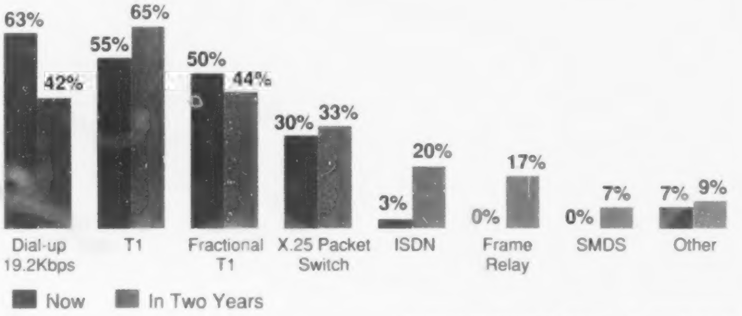
Survey respondents are also moving toward use of faster transmission speeds. True, many are still using dial-up modems at speeds of 19.2 kilobits per second or lower for WAN links, but not for long. Panel members say that within the next two years they will more often be using full T1 and fractional 64Kbps T1 links for their LAN-to-LAN communications.

Panel members also say they are moving toward several other emerging technologies for their WAN service needs. A solid 33% of respondents expect to use fast-packet switching in the future, up slightly from 30% now. And members expect dramatic growth in the deployment of other new technologies: 20% expect to use Integrated Services Digital Networks (ISDN) in the future, whereas only 3% use them now. And although none use them now, 17% expect to implement frame relay technology and 7% to employ switched multimegabit data services (SMDSs) in two years. ▭

For more information, call Nancy Finn at (617)-964-6204, fax her at (617)-558-4402 or write to her at the Business Research Group, 275 Washington Street, Newton, MA 02158.

Who Wants Which WANs?

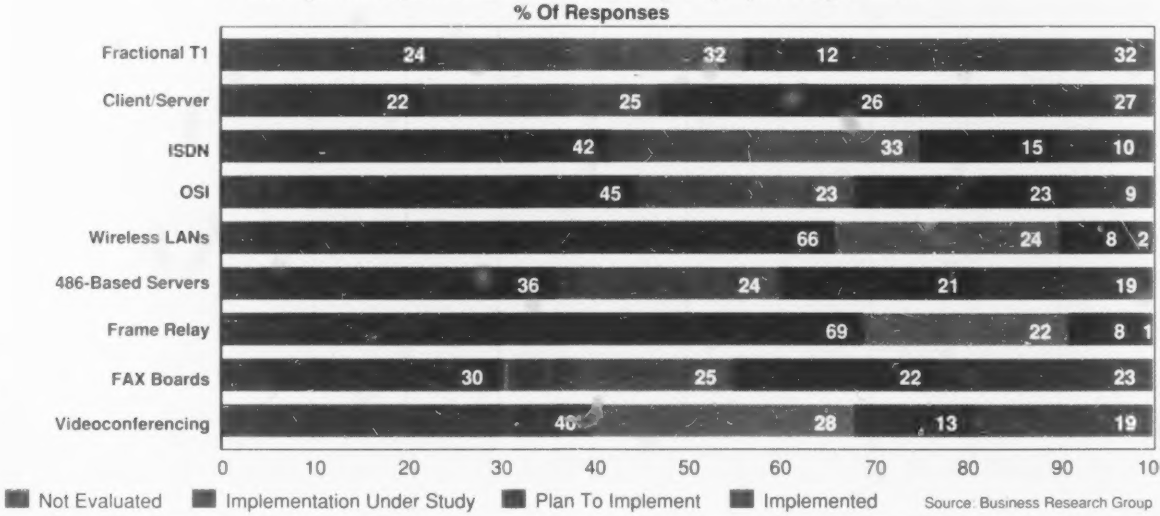
Types of WAN connections panel members are using or plan to use to connect their PC-based LANs.



Source: DATAMATION, Business Research Group

DATAMATION's Technology Implementation Index: Networks/Communications

DATAMATION each month surveys a select group of its readers--the DATAMATION Technology Panel--to investigate the implementation of new technologies by key user organizations.



Source: Business Research Group

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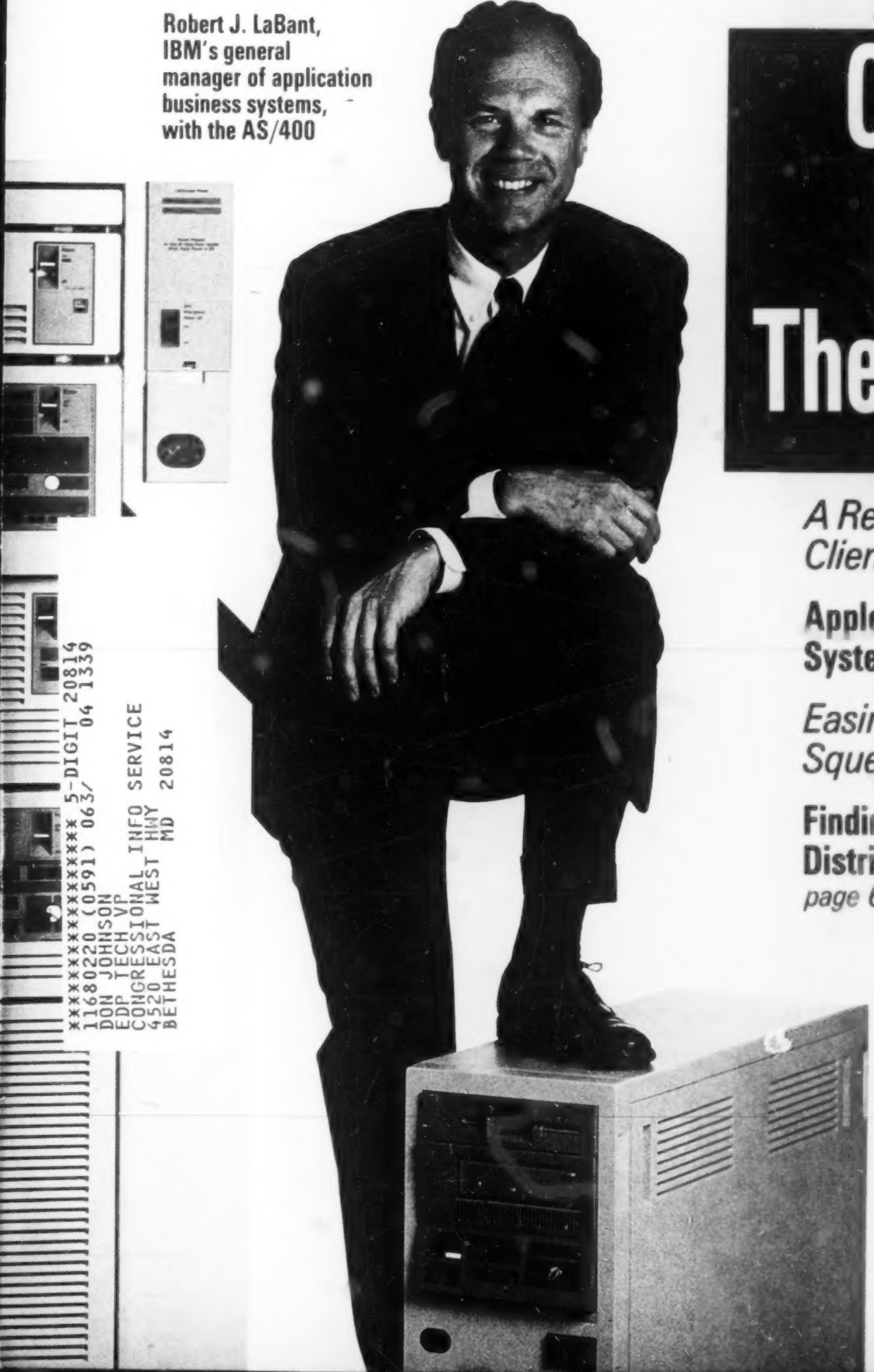
FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE

JULY 15, 1991



Robert J. LaBant, IBM's general manager of application business systems, with the AS/400

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JULY 15,
1991

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FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE

VOLUME 37
NUMBER 14

COVER STORY

MIDRANGE SYSTEMS

Can IBM Recast The AS/400? 28

BY JOHN McMULLEN Since its introduction, IBM's AS/400 has played a traditional minicomputer role. Now it's auditioning for a starring role as a network server.

Cover photography by Arnie Adler/Blackstar

SPECIAL REPORT

CLIENT/SERVER

Where Client/Server Fits 36

BY DWIGHT B. DAVIS

Early implementers are steering clear of the twin rocks: shooting the mainframe or just using the PC for a graphic front end. Instead, client/server pioneers are using the technology to build more useful and efficient database systems.

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Calculating From Scratch 73

BY ELIZABETH LINDHOLM

MathSoft wants its MathCAD calculation software to replace scientific calculators and 1-2-3 in the hearts and minds of engineers everywhere.

MathSoft's Razdow wants MathCAD to be the 1-2-3 for engineers.

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A Revelation In Client/Server Tools 42

BY MIKE RICCIUTI AND PAUL PINELLA With robust development tools such as Advanced Revelation, corporations are putting systems once relegated to the mainframe onto PC LANs.

OPERATING SYSTEMS

Apple's Switch To System 7.0 46

BY JOHN McMULLEN System 7.0 is now a reality, and programmers can't wait to tap into Apple's new Macintosh operating system. But until compatibility issues are resolved, some end users will have to wait.

PROFESSIONAL GROUPS

PC Managers Group Casts Wider Net 48

BY MIKE RICCIUTI The New York-based Microcomputer Managers Association is expanding beyond the Big Apple to help PC managers everywhere meet their professional goals.

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Easing The Data Center Squeeze 53

BY TOM McCUSKER Thanks to channel extenders, far away peripherals act like they're in the same room as the mainframe, clearing space for more DASDs and cutting remote staffing needs.

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ROUTERS

Push LANs Through Low-Speed Lines 57

BY TOM McCUSKER An innovative compression router not only directs traffic efficiently on a LAN internetwork but also allows the use of low-cost, dial-up lines.

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Finding The Right Distribution Software 61

BY MARILYN J. COHODAS Integrating financial management systems may be important to manufacturers today; but firms that don't integrate order, production and distribution systems may end up with no finances to manage.

LANGUAGES

Smalltalk Grows Up 64

BY JEFF MOAD Thanks to a boost from IBM and Microsoft, and a growing set of support tools, Smalltalk is finally beginning to sound good to IS.

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SECURITY

Smartcards: Smarter Than Passwords 69

BY LAMONT WOOD These days, user IDs and passwords are universal. But with the value of data skyrocketing, you may want to add token-based authentication.

Seafirst's Harburg has gone client/server to take a load off his mainframes, page 36.

The Nature Conservancy has gone client/ server to take a load off the environment, page 42.

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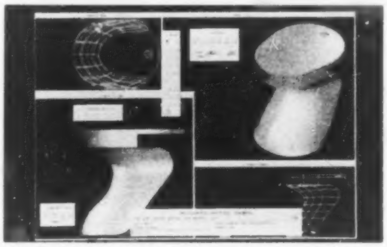
SOFTWARE

CAD Plus C

Intergraph Corp. recently unveiled MicroStation PC version 4.0, the newest release of its PC-based computer-aided design (CAD) package. The software includes the MicroStation Development Language—a full implementation of C—for creating CAD applications. Its graphical user interface now complies with the OSF/Motif GUI.



MICROSTATION PC 4.0 provides tools for creating three-dimensional objects.

Intergraph has also added tools for 3-D modeling. New features for creating wire frame models include automatic, multiline placement; intersection clean-up; and associative dimensioning. Its nonuniform B-spline surfacing features allow for easier modeling of sophisticated 3-D surfaces. Users can add nongraphical data to CAD designs through links to the Oracle relational database manager.

The $3,450 package requires at least an 80386-based personal computer equipped with a math coprocessor. INTERGRAPH CORP., Huntsville, Ala.

Circle 540

Cleaning Up DB2

Faver For DB2, from Goal Systems International Inc., speeds up the copying, restoration and organization of DB2 databases.

Database administrators can specify what parts of a database need to be changed. Faver's copy facility generates dual copies of files in a single pass to reduce time and CPU use, and it can reset the modifications on any changed page. The reorganization facility frees up and optimizes unused space created by dropped tables and speeds up the reorganization of partitioned table spaces. Prices range from $10,000 to $35,000. GOAL SYSTEMS INTERNATIONAL INC., Columbus, Ohio.

Circle 541

PCs & WORKSTATIONS

DEC Gets Two ACEs In The Hole

Digital Equipment Corp.'s recent rollout of the DECstation 5000/100 series workstations marks the company's participation in the Advanced Computing Environment (ACE) vendor consortium. The two models in the RISC series, the Model 120 and the Model 125, run the ULTRIX operating system.

The DECstation series supports five different graphics subsystems, providing users with a range of configurations options for 2- or 3-dimensional graphics. The 20-megahertz Model 120 has a performance rating of 13.9 SPECmarks; the 25Mhz Model 125 is rated at 16.4 SPECmarks, according to Digital. Prices start at $6,495 for the Model 120 and $8,495 for the Model 125. DIGITAL EQUIPMENT CORP., Maynard, Mass.

Circle 542

Japanese On The Desktop

With BIKAN JALM software, users can produce Japanese characters for graphics and desktop-publishing applications.

Running Microsoft Windows 3.0, BIKAN JALM gives users access to Japanese character sets including kanji, katakana and hiragana. Characters can be exported in Windows Metafile, TIFF and EPS file formats. Users can input more than 7,000 Japanese characters using a standard IBM keyboard. Users can also input Japanese words using the Roman alphabet (called romaji); the software converts romaji into Japanese characters. BIKAN JALM is priced at $695. KNOX COMPUTER SYSTEMS INC., San Diego.

Circle 543

A New Lightweight In The Ring

Measuring 12.2 × 1.7 × 10 inches, the 6.8-pound CF-370H6 Business Partner notebook computer is small enough to fit inside most briefcases.

THE CF-370H6 NOTEBOOK provides 1MB of memory in a 6.8-pound unit

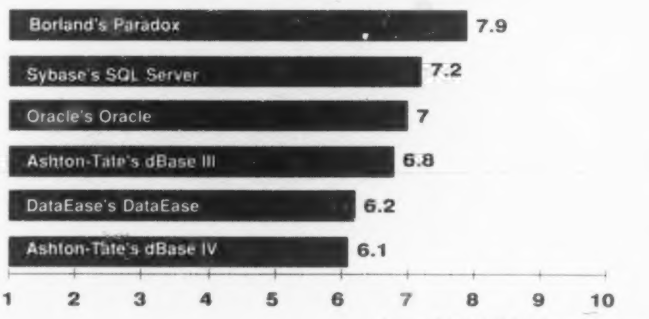
The 20-megahertz, 80386SX notebook comes with 1 megabyte of memory, expandable to 5MB; a 3.5-inch, 1.44MB floppy disk drive; a 60MB hard disk; and a 3-hour rechargeable battery.

The CF-370H6's resume function allows users to stop work and later return to their program without rebooting the system or reloading the software. The

IS Satisfaction Scorecard: Databases

Does your database measure up? DATAMATION surveyed IS managers who have purchased microcomputer database software to determine their level of satisfaction. Borland Paradox owners reported the highest level of satisfaction with their purchase, and dBase IV owners are less happy than those who stayed with dBase III.

(1=Not satisfied, 10=Most Satisfied)



Source: DATAMATION, December 1990

MARKET INSIGHTS

AN ANALYSIS OF ECONOMIC TRENDS

Communications Industry Evades Recession

BY MADELINE FRANCHI
Cahners Economics

Ebbing business confidence throughout the Persian Gulf crisis and uncertainty about the direction the economy would take has stalled spending on capital equipment by U.S. businesses, including purchases of communications equipment. In the first quarter of this year, U.S. businesses spent an annualized $51.67 billion for all types of communications equipment, which includes telephone, microwave and computer-networking hardware. In inflation-adjusted dollars, investment in communications equipment amounted to $38.76 billion, a drop of 1% relative to first-quarter 1990's level.

But we don't expect the weakness to last long, thanks in part to a recent rise in U.S. business confidence and in part to steady strength in U.S. export sales of communications equipment.

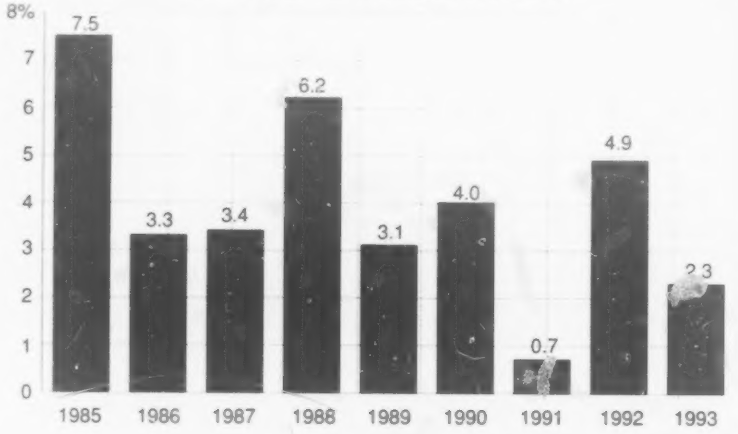
Cahners Economics expects a mild rebound in growth for purchases of communications equipment by U.S. businesses through early 1993. U.S. investment in communications gear is forecast to rise by 5% in 1992 and 3% in 1993, about average for the industry over the last five years.

Cahners Economics expects international shipments by U.S. factories of communications equipment to increase at 4.3% this year, which is slow for worldwide sales, and follows 1990's strong 10.8% rise. But worldwide sales of communications equipment will most likely turn up again, as the world's industrial nations slowly fend off their latest cyclical downturn. By next year, in fact, the international economy is expected to strengthen enough to boost shipments of communications products by 6.4% in 1992 and 7.2% in 1993.

For more information on Cahners Economics's forecasting services, including seminars, newsletters and database diskettes, call Dan Buchan at (617)-630-2105, fax him at (617)-630-2100 or write to him at Cahners Economics, 275 Washington Street, Newton, MA 02158.

This Year The Slump, Next Year The Rebound

Domestic purchases of communication equipment by U.S. businesses (annual % change, 1982 dollars)



Source: U.S. Commerce Dept.; forecasts, Cahners Economics

The Economy At A Glance

U.S. Economy: Macroeconomic And Industrial Indicators

	Actual		Forecast (Annual % Growth)		
	Q4/90	Q1/91	1990	1991	1992
Gross National Product	-1.6	-2.8	1.0	0.1	3.1
Business Investment In Equipment	6.3	-15.5	2.8	0.8	4.5
Government Spending	4.7	-2.3	2.8	-0.6	0.5
Consumer Spending	-3.4	-1.4	0.9	0.1	3.0
Exports	11.0	0.4	6.4	2.8	5.1
Imports	-11.8	-6.9	2.8	0.5	4.3

All calculations are % change in 1982 dollars. quarterly figures are seasonally adjusted annual rates

Manufacturing Production (1)	March 1990	Feb. 1991	% Change 3/91-2/91	March 1990	% Change 1991-1990
Process Industries Total	104.1	104.4	-0.2	107.6	-3.3
Chemicals	108.6	109.3	0.6	109.5	-0.8
Petroleum	109.3	108.5	0.7	109.1	0.2
OEM Total	107.7	108.5	-0.7	113.5	-5.0
Computers & Peripherals	156.1	157.1	-0.6	147.3	6.0
Communication Equipment	110.1	109.6	0.5	109.0	1.0
Transportation Equipment	95.0	95.6	-0.6	107.9	-12.0
Services Employment (2)					
Finance, Insurance, Real Estate	6.779	6.764	0.2	6.774	0.1
Health Care	8.510	8.456	0.6	7.930	7.3
Computer & Data Processing	0.837	0.834	0.3	0.790	5.9
Transportation/Utilities	5.775	5.772	0.1	5.750	0.4
Retail Trade	19.115	19.094	0.1	19.361	-1.3
Wholesale Trade	6.219	6.219	0.0	6.326	-1.7
Government	18.741	18.645	0.5	18.536	1.1

(1) Index 1978=100, seasonally adjusted
(2) Millions of persons, not seasonally adjusted

Source: Commerce Dept. and Cahners Econo[illegible]

MARKET INSIGHTS

A SURVEY OF TECHNOLOGY TRENDS

Users Want Multimedia Applications

BY WARREN CHILDS
Business Research Group

Multimedia technology is on the way to becoming big business. The industry has already agreed on, or proposed, most of the necessary standards for successful multimedia applications, and only a few critical technology barriers are left.

The most recent survey of the DATAMATION Technology Panel reveals that 20% have already implemented multimedia applications or plan to in the near future. Another 29% are currently in the process of evaluating the technology. In another survey recently conducted by the Business Research Group, nearly two-thirds of 200 desktop system buyers at *Fortune* 1,000 companies said they believe it will be important for desktop systems to be able to manage multimedia applications by 1995 and integrate graphics, sound, text and data.

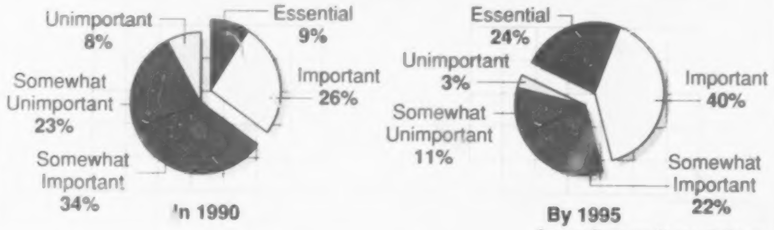
Multimedia systems are broadly defined to include any application that integrates text, graphics, voice and full-motion video. Microsoft Corp. has established a set of specifications that many see as the first step in forging an industry standard for system configuration. These specifications, named Multimedia PC (MPC), require a system with at least a 286 microprocessor, 2 megabytes of random access memory, a 30-megabyte hard drive, a 4-bit or 8-bit VGA video display, and Windows 3.0 or equivalent.

Although most multimedia applications have been targeted so far at the home and education markets, businesses are beginning to find important commercial uses for the technology, as well. For example, multimedia systems are proving to be an effective way to bring advertising closer to the point of sale. Interactive kiosks located in airports and convention centers allow travelers to view a variety of travel, hotel, dining, and entertainment options for any U.S. city. ▭

For more information, call Nancy Finn at (617)-964-6204, fax her at (617)-558-4402 or write to her at the Business Research Group, 275 Washington Street, Newton, MA 02158.

The Multimedia Bandwagon Gets Rolling

Desktop system buyers were asked to rank the importance of integrated multimedia capabilities for desktop systems purchased in 1990 and planned for 1995.

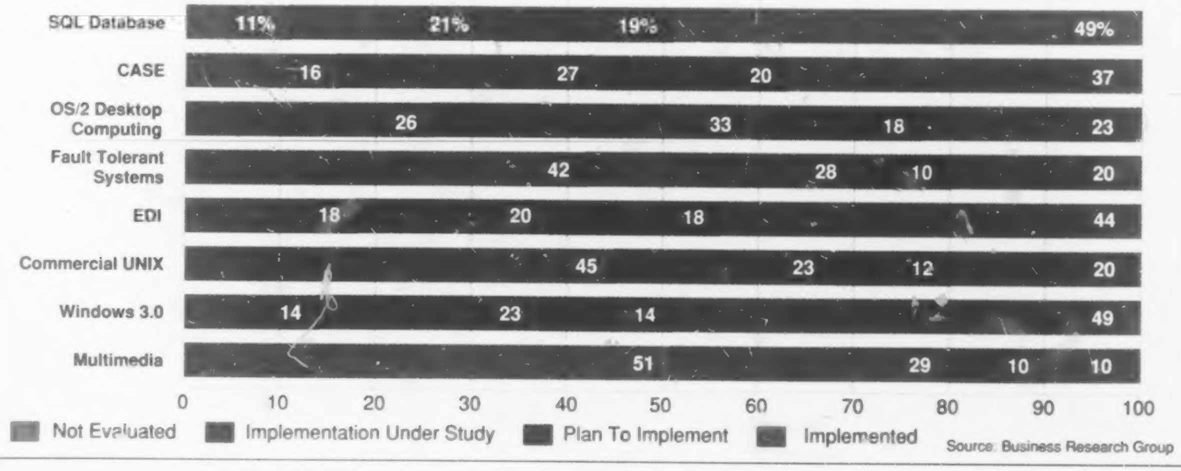


Source: Business Research Group

DATAMATION's Technology Implementation Index: Systems And Software

DATAMATION each month surveys a select group of its readers--the DATAMATION Technology Panel--to investigate the implementation of new technologies by key user organizations

% OF RESPONSES



Source: Business Research Group

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FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE

AUGUST 1, 1991

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Larry Moore,
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Lotus Notes: A combination document creator, database generator and messaging platform.

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IS Puts Notes To The Test 24

BY MARK SCHLACK At more than 80 companies, IS managers are finding out if Notes is the software that will do for teamwork and group communications what spreadsheets did for accountants.

Cover photography by Dave Bradley

SPECIAL REPORT

OPEN SYSTEMS

The Distributed Connection: DCE 28

BY J. WILLIAM SEMICH
Starting next month *open* won't just equal *UNIX* anymore. Thank IBM and all the other proprietary vendors for building the Open Software Foundation's Distributed Computing Environment technology into their products.

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Transactions On The Desktop 67

BY ELIZABETH LINDHOLM Digital Equipment Corp. is out to redefine transaction processing. The benefits for IS managers are speed, an easy growth path and access from the desktop.

Digital's Roberson has an API for desktop transaction-processing programs.

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BY PAUL PINELLA A growing array of Windows 3.0 development tools are paving the way for a new generation of in-house applications. But for corporate developers, picking the right tool for the right job is no simple task.

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How To Minimize Upgrade Hassles 38

BY BOB FRANCIS Tired of updating hundreds of PCs for every new software upgrade, many companies are using their LANs to centralize software distribution. But some decentralized firms remain cool to the idea.

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BY MARK SCHLACK Inexpensive LANs offer basic print and file sharing capabilities for small work groups and branch offices where enterprise networks can't be justified or supported. But there are some gotchas.

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BY TOM McCUSKER A new round of tape drive software lets IS automate and control the backup, maintenance and retrieval of LAN data. Gone are the days when backup depended on end-user diligence.

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BY NED SNELL Software services consultants are peddling their reengineering skills and toolsets as a quick and easy way for IS shops to rebuild their aging applications into new CASE packages.

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Unicode Breaks The ASCII Barrier 55

BY JOHN R. VACCA ASCII looked great in the '60s, but it's just an ugly American in the global '90s. Now Aldus, Apple, IBM, Microsoft and Xerox are trying to replace ASCII with Unicode—the code of a thousand character sets.

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BY JEFF MOAD Even elaborate data centers equipped with the latest uninterruptible power supplies may not be safe from all power outages. The solution is surprisingly simple, but few vendors are rushing to supply it.

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Paying The Price For Better Storage 63

BY JEFF MOAD Managers with large storage needs are finding IBM's DASD prices are no bargain. And, with PCMs dropping out of the 3390-compatible market, IBM has few reasons to lower its prices.

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American Airlines's Pendleton expects simplified software distribution once LANs connect the company. page 38

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LAN Backup Software Gets Smarter

A new round of tape drive software lets IS automate and control the backup, maintenance and retrieval of LAN data. Gone are the days when backup depended on end-user diligence.

BY TOM McCUSKER

Backing up local area network data used to be a dreary chore that got done if you thought of it. "If backup was in the closet, and if the person in charge of backing up data physically had to go in there and mount a tape and turn the drive on, he didn't always do it," says Michael Peterson, president of Peripheral Strategies Inc., a Santa Barbara, Calif., consulting firm that follows LAN backup trends.

Now, using the newest tape backup software for IBM and compatible PCs, IS managers can leave the tape drive in the closet and let it work unattended. Or, more likely, they can put the tape drive on the server in the data center and make LAN backup part of routine operations. Due to more mature hardware and software, LAN backup systems are finally becoming data management systems, with attendant scheduling, grooming, archiving and retrieval capabilities.

Several products are already available, and a flood of new ones will be hitting the market over the next six months. Some software comes packaged with tape drives, but may also be available on its own. Several software vendors are broadly selling their products entirely unbundled from tape drives. In all cases, the backup software will work with any brand of tape drive for which the software vendor has written a driver.

More powerful backup software couldn't come at a better time.

"Humans can't manage gigabytes of data and millions of files," says Peterson in explaining the rapid growth of tape backup hardware and software. "It's not unusual in a 1,000-node network to find a person spending half their time dedicated to doing single file restores and managing disks capacity problems."

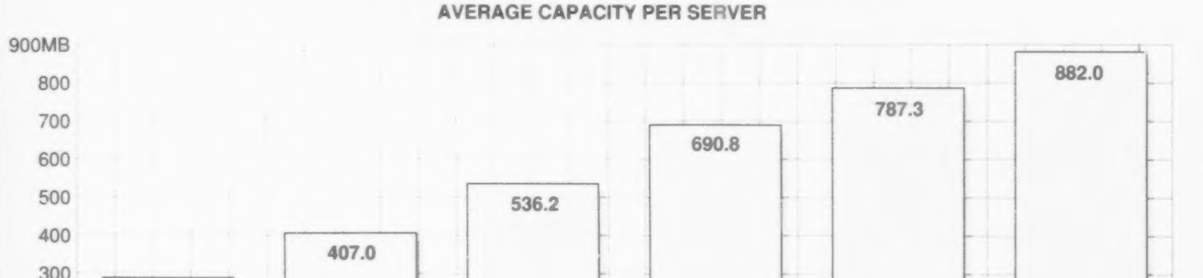
"It's even worse on engineering workstations, where a user could have several gigabytes on his desk," says Charles J. Holland, vice president of marketing at Epoch Systems Inc., a Westborough, Mass., supplier of backup subsystems for UNIX-based networks.

At Your Server

That's why it's not surprising that growth in the LAN backup market is accelerating. Peripheral Strategies estimates that, based on end-user prices, the LAN backup market will grow this year by half a billion dollars, or almost 40%, to $1.8 billion. It grew by $200 million,

How LAN Storage Is Growing

Between 1990 and 1995, average capacity per server will nearly triple to 882MB, while the actual number of servers per network will more than double to 4.2.



Source: Peripheral Strategies Inc.

Selected PC Tape Drive Software Vendors

The following companies are among the leading vendors of software for server-based tape drives on PC LANs.

Cheyenne Software Inc.
Roslyn, N.Y.

ARCserve. An automated, centralized backup/restoration product that enables uninterrupted, unattended backup services for both file servers and workstations. Price is $1,195 for NetWare 286 and $1,895 for NetWare 386. **Circle 350**

Emerald Systems Corp.
San Diego

EMQ. Server-based product supporting Microsoft's LAN Manager; priced at $795. **Circle 351**

EMQ NLM. Priced at $1,195; runs on Novell NetWare products. **Circle 352**

EMSAVE and **EMLIB**. Backup and restoration utilities for multiple servers; priced at $395 each. **Circle 353**

Scheduler. An entry-level product for unattended, scheduled backup of files on Novell networks. Software also supports Hewlett-Packard and Compaq systems. Priced at $1,295. **Circle 354**

Irwin Magnetic Systems Inc.
Ann Arbor, Mich.

EzArc. Based on Cheyenne Software's ARCnet product, provides backup on Novell LANs. Priced at $249 for five users or $999 for 100 users on NetWare 286 and $1,195 to $2,995 for 250 users on NetWare 386. **Circle 355**

Maynard Electronics Inc.
Lake Mary, Fla.

MaynStream and **LAN-Stream**. Back up for Novell NetWare and OS/2 LAN Manager servers. Both are bundled with Maynard tape drives. **Circle 356**

Mountain Network Solutions Inc.
Campbell, Calif.

FileSafe and **FileTalk**. Server backup software, bundled with the company's tape drives. FileTalk ($495) runs on workstations and enables the backup functions to be automated and establishes peer-to-peer connections. **Circle 357**

Palindrome Corp.
Naperville, Ill.

Network Archivist. Manages the whole tape backup process, removing decision making from the users. It performs tape rotation and scheduling and provides self-maintenance. Relational databases are used to track files. Base level is 360MB, priced at $695; 1.3GB is $995. **Circle 358**

Sytron Corp.,
Westborough, Mass.

Sytos Plus. Backup and restoration utility. Price is $225 for a DOS version and $295 for OS/2. In the DOS version, the software is resident on workstations; it can be both server and workstation based under OS/2. In a server-based configuration, single and multiple servers, as well as workstations with peer-to-peer services installed, can be backed up. **Circle 359**

Tecmar Inc.
Solon, Ohio

ProServ. This is a component of Tecmar's ProLine network backup subsystem for Novell's NetWare 386 and later products. ProServ is Cheyenne's ARCserv product optimized for Tecmar's hardware and, like the Cheyenne product, runs as both a Value Added Process (VAP) and Network Loadable Module (NLM) on NetWare products. ProServ VAP version is priced at $995; its NLM product is priced at $1,695. **Circle 360**

Source: DATAMATION, company reports. Circle numbers appear on Reader card.

just over 18%, last year.

The improvements in backup software complement the growing strength of LAN tape backup hardware. Tape drives can now handle up to 5 gigabytes. And on the restoration side, recent hardware innovations have vastly improved the recovery rate for files. For example, Exabyte Corp.'s model 8200 and 8500 8-millimeter tape drives, introduced last year, were designed to provide an eightfold reduction in access time, from 8 minutes to 68 seconds.

With tape-drive hardware gaining industrial strength capacity and performance, software that once supported workstation backup needed to be retooled as server-based backup products to take advantage of the edge in transfer speeds. Hardware suppliers who offered workstation-based backup software found themselves suddenly having to "go back to the drawing board to provide server-based products," says Gene Della Tore, backup products manager with Tecmar Inc. Some companies, including Tecmar and Irwin Magnetic Systems Inc., opted to jump into the server market right away by acquiring the rights to sell a server-based software product made by Cheyenne Software Inc. called ARCserve.

But, from a features point of view, analyst Peterson ranks Palindrome Corp. as the leader in network data management software products. Palindrome was among the first to offer what vendors call intelligent backup, with a systems storage management product called The Network Archivist, introduced in late 1988. Intelligent backup automatically keeps track of when the data have been backed up last, how secure they were and how frequently they were changed.

The idea behind intelligent backup is that "people press one button, and they're able to do a backup," explains Nancy Harbin, manager of product planning at Irwin Magnetics. "They don't have to specify what's being backed up. It's done intelligently for them."

Intelligent backup may not be for everybody. Some IS managers have complained that the no-brainer approach robs them of the flexibility they would like in deciding which files are backed up and at what frequency.

The majority of software products for the network data backup market address Novell NetWare drives. But products that address other operating systems are also surfacing.

"Corporate America is not just Novell networks anymore," says Dan Stromska, product manager with Mountain Network Solutions Inc. The firm's new DMS software line will enable LAN administrators to manage data across multiple operating and network environments. "We're talking of a product that will run under Microsoft Corp.'s LAN Manager, Apple Computer's Appletalk and UNIX NFS-based networks," Stromska says.

Not Just NetWare

Peterson, at Peripheral Strategies, says that when the DMS products become available this summer and fall, they may shoot Mountain to the top of the list of backup software vendors. However, he does expect companies like Cheyenne and Palindrome to respond with competitive products. Cheyenne, for example, is scheduled to support Macintosh and NFS UNIX clients attached to a NetWare server in a fall release of ARCserve.

Sytron Corp., in Westborough, Mass., is also increasing the range of platforms that its widely used Sytos Plus software runs on. Right now, it works on standalone DOS and OS/2 machines, as well as on LAN Manager servers. It can be used for workstation-based tape backup on NetWare networks. By the end of next year, there will be a Network Loadable Module (NLM) version for NetWare 386 servers, says Stephen Gentile, Sytron's marketing manager.

Maynard Electronics Inc. is addressing local limitations of tape backup on NetWare LANs with a new feature of its MaynStream software. It will gain the ability to log in and out unattended on an unlimited number of servers. (NetWare allows you to log into only eight servers at a time.) The new feature will give MaynStream a wide area network capability. LANStream, a new client/server implementation, lets users treat the tape drive as a shared device.

Perhaps the future direction of PC LAN backup can be gleaned from the news that Epoch Systems hopes to port its UNIX backup and archival technology down to PC-based systems within a year or two. Epoch's systems automatically back up hard drives to tape and then move files that have been inactive for a set period of time to optical storage jukeboxes. The systems handle 20 gigabytes to 1 terabyte of data. Such a product would bring a new level of sophistication and power to PC LANs. ▭

NEW PRODUCTS

A SELECTION OF RECENT INTRODUCTIONS

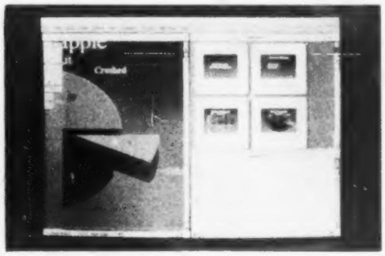
PRODUCT REVIEW

SOFTWARE

Harvard Graphics Does Windows

Version 3.0 of Harvard Graphics now supports Windows 3.0 and provides enhancements that give users more freedom to edit and embellish their charts.

Predefined layout regions for legends, titles and so on allow users to change chart attributes a section at a time rather than one line at a time. And users who are tired of the old X-Y bar charts can spruce them up with cylinder-, octagon- and pyramid-shaped bars. A spreadsheet view lets users select data without accessing a spreadsheet program. A WYSIWYG drawing option provides more than 35 drawing tools, and users can doodle or work through new ideas on a scratchpad without affecting the current image or chart on screen.



HARVARD GRAPHICS USERS can create three different working views of a chart

Version 3.0 requires at least a 286-based system with 438 kilobytes of free random access memory on a 640KB system; DOS 3.1 or later; a hard disk; and an EGA or VGA graphics card. The software retails for $595; current users can upgrade for $125. SOFTWARE PUBLISHING CORP., Mountain View, Calif.

Circle 530

A CASE For Integration

AD/Advantage, a full life cycle application development system, includes tools designed to simplify all phases of application development. It also helps ease the burden of cross life cycle activities like resource, documentation and change management.

Although AD/Advantage fits into IBM's AD/Cycle framework, it is based on an open architecture, enabling developers to port their applications to other platforms and use other sources for project specifications. The product integrates seamlessly with some upper CASE tools, including Intersolv Inc.'s Excelerator and KnowledgeWare Inc.'s IEW and ADW.

AD/Advantage runs on IBM mainframes under the MVS and VSE/CICS environments. It provides links to DOS and OS/2 development platforms, allowing IS managers to off load development chores from the mainframe. Prices range from $50,000 to $500,000. CINCOM SYSTEMS INC., Cincinnati.

Circle 531

Take Your Show On The Road

Business & Professional Software Inc.'s new 35mm Express/Laptop includes special features for laptop users who need to make presentations on the road.

The package includes integrated communications facilities that let the on-the-go presenter fax a presentation to a colleague for proofing or approval and send presentations to color-slide service bureaus via modem. The package also includes automatic layout, presentation management capabilities and support for 64 colors. Presentations appear in monochrome on an LCD display and print in color.

The $295 software runs on notebook, laptop and palmtop computers, and a version is available for Poqet computers, which use proprietary magnetic media. BUSINESS & PROFESSIONAL SOFTWARE INC., Cambridge, Mass.

Circle 532

PCs & WORKSTATIONS

A Colorful UNIX Protégé

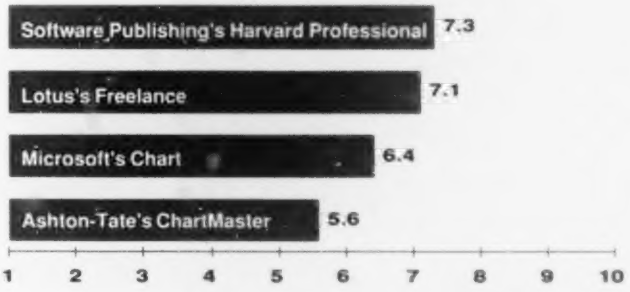
The Protege cf series from Mobius Computer Corp. include three workstations that bring color to the UNIX world at X-terminal prices, according to the vendor.

The top-of-the-line Mobius Protege

IS Satisfaction Scorecard: Graphics

DATAMATION surveyed IS managers who have purchased PC graphics software to determine their level of satisfaction. Owners of Harvard Professional Graphics and Lotus Freelance reported almost equal satisfaction with their purchases. ChartMaster and Microsoft Chart owners, however, are less satisfied.

(1=Not satisfied, 10=Most satisfied)



Source: DATAMATION, December 1990

MARKET INSIGHTS

AN ANALYSIS OF ECONOMIC TRENDS

Oops! Our Forecast Was Too Rosy

BY MADELINE FRANCHI
Cahners Economics

A sudden weakness in the DATAMATION Information Systems Performance Indicator (ISPI) has put the lie to our forecast last month of an imminent upturn for the IS industry. We expected a steady rise in the indicator, which seemed to have turned upward in February, but it didn't happen that way. Final data in for April show that the ISPI inched downward to 95.52 that month—not up to the 96.73 we had estimated.

Although the difference may not seem that large, the important issue here is the word *downward*. The direction is wrong for a forecast of speedy recovery. That means an even slower recovery than the already slow expansion we had originally forecast.

What went wrong? New orders for information systems, which had been showing renewed gusto in January and February, reverted back to their old ways in April. In particular, computer makers suffered at the hands of shifting product demand and sliding prices. Orders for this portion of the information systems aggregate toppled 6.8% in April below the same period of 1990—a one-year loss not matched since February 1989.

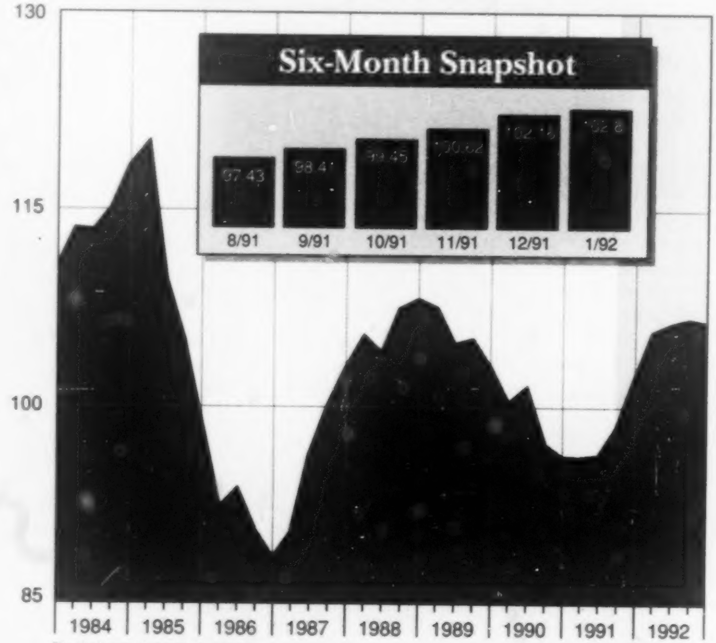
Stock market investors ran for cover when they discovered computer company profits heading for the tank, which pushed the Standard & Poor's computer systems stock price index down sharply in April and May, as a result. That index carries a lot of weight in the weighted average of factors that make up the ISPI.

Can the IS industry look forward to any good news? Yes, but it won't be visible to the naked eye until year's end. Growth in new orders for information systems is forecast to turn up in the third quarter. ▭

For more information on Cahners Economics's forecasting services, including seminars, newsletters and database diskettes, call Dan Buchan at (617)-630-2105, fax him at (617)-630-2100 or write to him at Cahners Economics, 275 Washington Street, Newton, MA 02158.

The IS Performance Indicator

Last month's forecast of strong improvement was a tad premature.



Shaded area denotes forecast

Source: Cahners Economics

	April 1990	March 1990	% Change 3/90-2/90	April 1989	% Change 1989/1990
■ **Information-Processing Equipment**					
Shipments (SA, $ billions)	9.34	9.33	0.0	9.39	-0.6
New Orders (SA, $ billions)	8.87	8.91	-0.5	9.42	-5.8
Unfilled Orders (SA, $ billions)	28.05	28.52	-1.6	27.19	3.2
Inventory (SA, $ billions)	16.17	16.03	0.9	17.43	-7.2
■ **Computer Production Workers**					
Employment (NSA, thousands)	267.4	269.7	-0.9	281.2	-4.9
Average Weekly Hours (monthly avg.)	39.8	40.2	-1.0	41.5	-4.1
■ **Stock Index**					
S&P's Computer Systems Stock Price Index	172.6	187.9	-8.1	192.0	-10.1
■ **Contracts & Orders**					
New Plant & Equipment (SA, $ billions)	33.4	37.3	-10.5	41.3	-19.0

SA= seasonally adjusted;
NSA= not seasonally adjusted

Source: U.S. Commerce Dept., Standard & Poor's; forecasts: Cahners Economics

NOTE: The U.S. Commerce Department revised all historical data on shipments, orders, inventory and unfilled orders. Therefore, you will notice revisions in the ISPI compared with previous issues of this magazine.

MARKET INSIGHTS

A SURVEY OF TECHNOLOGY TRENDS

MIS Leads In Business Redesign

BY WARREN CHILDS
Business Research Group

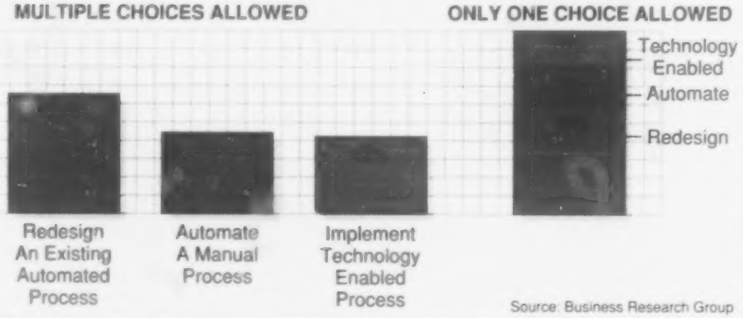
When businesses look for ways to reduce costs while maintaining or even improving the quality of their products, more often than not these days they are turning to MIS for the solutions.

The most recent survey of DATAMATION's Technology Panel shows MIS managers are being asked to use technology to change fundamentally the way their companies do business, to find less costly or more efficient ways to operate. Nearly all panel members (97%) are involved in developing new "business-critical" applications—that is, applications that directly contribute to a business's ability to generate revenue.

Panel members face three choices when deciding how to implement these new applications—redesign existing automated processes, automate processes that were previously manual or bring in new technology to create applications that enable a company to perform totally new business activities.

How MIS Targets Corporate Goals

MIS managers' preferred approaches to using information technology to help boost corporate efficiency and reduce costs.



Source: Business Research Group

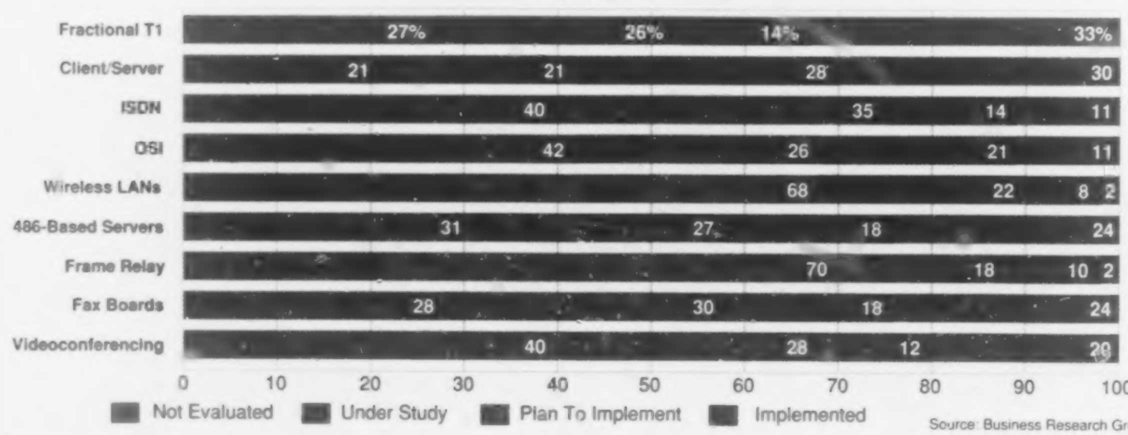
By far, the most widespread approach, mentioned by some 65% of those surveyed, is to redesign existing automated processes and procedures to make them more efficient. Take, for example, a customer service operation in which operators manually call up account files to their automated workstations. Several seconds per call can be saved by implementing computer-to-PBX links that send account files automatically to the operators based on information obtained electronically from the incoming call.

In order to implement new business-critical applications, 44% of panel members say they plan to automate previously manual processes and procedures. Another 42% say they expect to bring in totally new information technologies to help implement new business practices that wouldn't be feasible without these advanced applications. ▭

For more information, call Nancy Finn at (617)-964-6204, fax her at (617)-558-4402 or write to her at the Business Research Group, 275 Washington Street, Newton, MA 02158.

DATAMATION's Technology Implementation Index: Networks/Communications

DATAMATION each month surveys a select group of its readers--the DATAMATION Technology Panel--to investigate the implementation of new technologies by key user organizations



Source: Business Research Group

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AUGUST 15, 1991

Connecting The Enterprise

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Richard Meise (left), Fluent Machines Inc., Michael D. Zisman, Soft-Switch Inc. (center), Roger Dev (right), Cabletron Systems Inc.

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DATAMATION

VOLUME 37
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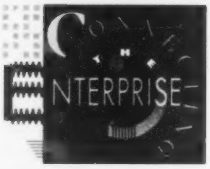
COVER STORY



Connecting The Enterprise 26

BY MARK SCHLACK

In this special feature section, we give voice to some of the philosophies and plans that IS organizations are following as they undergo the process of connecting the enterprise. We interviewed dozens of IS managers charged with developing their organizations' technical directions and asked them how they plan to use six key technologies during the next five years. We also spotlight the innovators in the vendor community and their breakthrough products.

Cover photography by Dave Bradley

Leading the frontier to enterprise computing (l to r): Fluent's Meise, Soft-Switch's Zisman and Cabletron's Dev.

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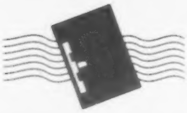
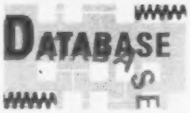


The Message Is Integration 31

BY TOM McCUSKER

With X.400 as a backbone, IS managers are taking advantage of interconnected e-mail to build messaging-capable applications that boost corporate efficiency.

Company To Watch: Soft-Switch Talks To Almost Everybody, page 33



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BY MIKE RICCIUTI AND J. WILLIAM SEMICH

Distributed databases can tie far-flung records into a single view. But a lack of products and murky standards are keeping many distributed wannabes on the sidelines.

Company To Watch: Empress Distributes Diverse Data, page 42

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Overdrive For Network Databases 47

BY JEFF MOAD IS managers are trying out high-end servers as part of their database downsizing plans. The hardware is impressive, but software to use that power is lagging.

Company To Watch: Parallan's Manageable Super Server, page 50

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Starring On Tomorrow's LANs 55

BY BOB FRANCIS AND PAUL PINELLA Voice, image and video on the LAN will unlock a wave of new applications, but successful integration depends on today's design decisions.

Company To Watch: Fluent Brings Multimedia To LANs, page 57

GATEWAYS

Solving The Multiprotocol Problem 61

BY SUSAN KERR Users are seeking to integrate gateways in system software to ease the burden of managing many stand-alone boxes. And gateway performance is on the rise.

Company To Watch: IBM Opens Gate To Communications, page 64

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Broadening The Management Umbrella 65

BY NED SNELL Today's crazy quilt is giving way to umbrella systems crafted from selected, standards-based network managers.

Company To Watch: Cabletron: Multivendor Management Made Real, page 67

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BY ELIZABETH LINDHOLM

Collecting information from remote locations can be an IS manager's biggest headache. XcellNet aims to make the process less painful.

XcellNet's Estes speaks to remote sites.

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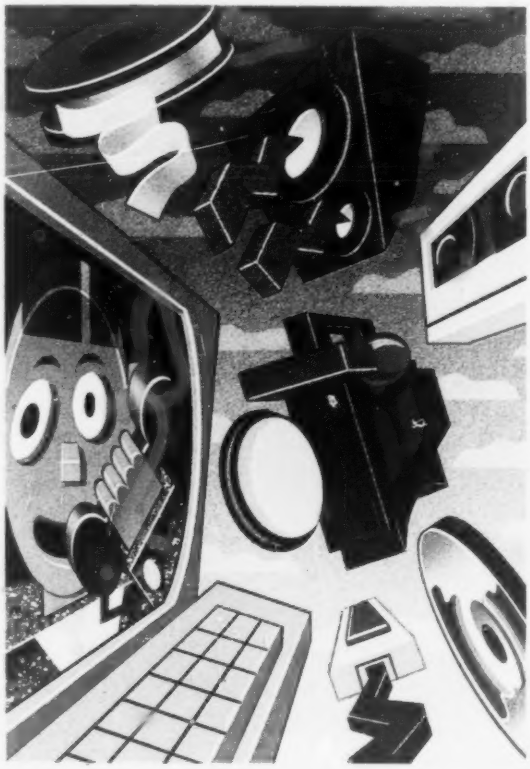
CONNECTING THE ENTERPRISE

Starring On Tomorrow's LANs

Voice, image and video on the LAN will unlock a wave of new applications, but successful integration depends on today's design decisions.

By Bob Francis and Paul Pinella

Information systems managers mulling over their future connectivity schemes should not restrict their thinking to the problems of typical data transfers. The world is fast becoming a digital place, and typical data in the future will likely include digitized voice, images and video.



These new data types will impose severe burdens on existing networks, particularly in building Ethernet or Token Ring local area networks. Ongoing work in data compression will go part of the way toward squeezing bandwidth-hogging data types into these relatively narrow pipes. But planners should also consider the potential use of nontraditional data when they look at new higher bandwidth local and wide-area networking technologies, like the Fiber Distributed Data Interface (FDDI) and Integrated Services Digital Networks (ISDN).

Until now, IS managers have tended to be only marginally involved with voice and visual data types. In the case of video, the technology traditionally has involved data communications managers acting as guardians of expensive stand-alone videoconferencing systems, satellite hookups and leased lines. That may change, however, as a trickle of products that transmit images, voice and data over ordinary phone lines and LANs begins to appear. Given the greater degree of integration that these systems require, IS managers will certainly be involved in planning and implementation issues.

According to Janet L. Hyland, director of network strategy research at Forrester Research Inc. in Cambridge, Mass., IS involvement is especially important if videoconferencing is to become a more mainstream technology.

Until now, IS managers have only been marginally involved with voice and visual data types.

"This business is not about videoteleconferencing, but about business communication. We're not talking about two-way television anymore. The interactive exchange of computer-based data is crucial in long-distance conferencing," she says.

The mix of computer-based data and video, as well as sound and image, is certainly an arena where forward-thinking IS managers have a chance to make an impact on their company's operations. Already, a number of pioneers are exploiting the current state of the art.

- At Target Department Stores, a division of Minneapolis-based Dayton-Hudson Inc., store managers hold a videoconference daily to check key buying trends at store sites.
- At the Superconducting Super Collider (SSC) Laboratory in Midlothian, Texas, videoconferencing is already playing a key role in designing—and keeping down costs—of the proposed multibillion dollar Superconducting Super Collider project.
- Vision Ten Inc., a systems integrator based in Torrance, Calif., is using Artisoft Inc.'s $99 Sounding Board as the basis for an X-ray imaging system that it sells to hospitals. Doctors use the sound board, an add-in board that digitizes sound, to voice annotate the X-ray images, which are then centrally stored on a file server and later on optical disc. The system eliminates the paperwork that once hounded doctors and X-ray technicians, and it automates the once-

VOICE IMAGING

Illustration by David Jonason

cumbersome image-filing process.

Promotional videos showing fully integrated voice/image/video/data computer systems have become commonplace at industry shows and conferences. Full integration is a laudable goal, but it will take years to get to. In the meantime, humbler, but worthwhile, systems can be achieved today.

Apple Computer Inc., for example, has included sound chips with its Macintosh computers for years and is now bundling a digital microphone with some of its Macintosh machines. PCs can use third-party sound boards from Tucson, Ariz.-based Artisoft and other suppliers. And independent software vendors are writing applications that allow voice messaging over e-mail and pop-up dictation within word processing, to name a few.

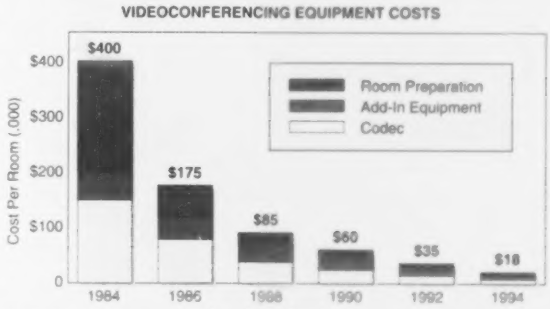
Full integration is a laudable goal, but it will take years to get to.

Linked Business Systems, a Minneapolis-based systems integrator is making do today with Ethernet and Token Ring LANs. LBS designs and builds PC-imaging systems based on the Metafile language from Metafile Information Systems Inc. of Rochester, Minn. Senior programmer Steve Watkins notes that stored images of most scanned-in paper documents take up only about 40 kilobytes of space after compression—hardly a challenge for today's LANs.

"But even this can be a problem when somebody wants to look at a 100-page document," he says. Watkins, like many others in his field, wants to see FDDI, with its high bandwidth, become widely implemented at the desktop.

Behind The Surge In Videoconferencing Sales

By 1994, dial-up videoconferencing equipment will cost a fraction of what high-end systems sold for 10 years earlier.



Source: Forrester Research Inc

Most experts agree that today's LANs can handle still image and audio applications without choking. The real challenge begins when full-motion video is brought into the picture. Hyland points out that one minute of full-motion video easily consumes 15 megabytes of disk space without compression.

Video Enters The Picture

Because of these limitations, when it comes to video, most organizations are not using their data networks. For those requiring the highest quality connections, high-end equipment systems that broadcast over full T1 or satellite links will do the trick. But the buy-in costs are high and transmission costs can run $400 an hour for a coast-to-coast conference.

That's why much of the action is shifting to lower-cost equipment and transmission lines. Using switched 56Kb per second lines can drive costs down to $30 per hour for transcontinental calls. But, there are some tradeoffs in picture quality, notably a blurring of movements.

The advent of low-cost scanners is moving imaging from an esoteric technology to a desktop one.

Three companies—Compression Labs Inc. of San Jose; PictureTel Corp. of Peabody, Mass.; and VideoTelecom Corp. of Austin, Texas—are the major systems players in affordable videoconferencing, according to industry analysts. Each has its camera eye zoomed in on the dial-up equipment market. The U.S. market, which hit $110 million in revenues for 1990, is estimated to reach $300 million in 1992, according to Tucker Anthony Inc., a Boston research group.

One of the fastest growing videoconference markets is for multipoint sites, where videoconferencing takes place with more than two sites participating. The multipoint market will likely grow as a new industry standard (CCITT's px64) takes effect, allowing various videoconferencing vendors to link their disparate systems together. In late 1989, GPT Video Systems Inc. of London, PictureTel and VideoTelecom demonstrated use of the standard and all major players since have announced upgrade plans that incorporate it.

One of the drawbacks of videoconferencing systems has been the inability of users to include computers in the call. One of the first products to push computer integration is VideoTelecom's Mediamax system, according to Forrester's Hyland. This IBM PC AT-based system allows users to manipulate data files in real time in multiple windows on their video monitors, as well as communicate both visually and aurally. For example, users at several sites may have Lotus 1-2-3 on the screen. They could make changes to the figures on line as if they were in the same room.

VideoTelecom isn't the only company that sees the trend toward greater computer integration. Videoconferencing pioneer Compression Labs has signed a licensing and OEM agreement with DataBeam Corp. of Lexington, Ky., to market that company's Data-Beam CT 500 interactive document-conferencing system, along with its own codecs—industry jargon for coders/ decoders. The CT 500 transmits full-page documents, computer graphics and photographs during a videoconference and allows meeting participants at each site to view, modify and annotate those images.

Toward Desktop Video

When today's dial-up videoconferencing systems include a PC, it's usually as a stand-alone appendage. Tomorrow's more sophisticated systems are likely to deliver full-motion video over LANs. In this way, participants will be able to join conferences without leaving their desks.

Even if LAN-based videoconferencing proves too difficult to accomplish over networks designed to carry more conventional computer traffic, desktop videotelephones that use the telephone network may still be practical. One low-end solution should be available by early 1992 from Compression Labs, according to a company spokesperson. The videophone will use a proprietary algorithm to produce color, full-motion video on a 4-inch screen, all for under $1,500.

Some companies may choose to wait, however, until they can put in higher-bandwidth data nets and bring any kind of data to the desktop. That will most probably mean a combination of ISDN for wide-area connections and FDDI for local and campus networks.

DATAMATION'S PRODUCT REVIEW

NEW PRODUCTS

A SELECTION OF RECENT INTRODUCTIONS

New products can provide the core technology for enterprisewide networks or just make network housekeeping less of a headache. To supplement our connectivity issue of DATAMATION, we've selected a sampler of products that touch all facets of connectivity. They range from new 3270 emulation software that can link desktops to mainframe applications to WAN utilities, to groupware designed specifically for multiserver architectures.

▶ SOFTWARE

3270 Emulation For System/6000

Firesign Software Inc.'s new 3270 emulation software gives RS/6000 users access to IBM mainframes.

3270ix allows remote users to connect to a mainframe with any AIX-supported terminal and printer and provides high-speed file transfer using IND$FILE. It also provides tools that let users design their own communications systems. The software is installed on top of Systems Network Architecture (SNA) services and complies with IBM's Systems Application Architecture (SAA), ensuring software compatibility with future LU6.2 applications or network changes. The $795 product is compatible with NetView and AIX Network Management/6000 and can be used on Token Ring, Ethernet, X.25 and Synchronous Data Link Control (SDLC) networks. FIRESIGN SOFTWARE INC., Ridgefield, Conn.

Circle 550

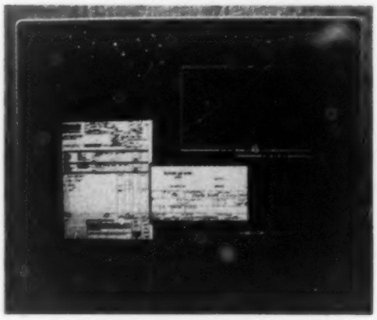
Pacing Terminal Emulation

Pacer Software Inc. based its new communications software for the Macintosh, PacerTerm, on Apple Computer Inc.'s Macintosh Communications Toolbox. CTB is a modular architecture that provides Mac applications with standardized access to terminal emulation, data connection and file transfer services.

PacerTerm provides TTY, VT102 and VT320 terminal emulation and file transfer using the FTP, Kermit, Xmodem, Zmodem and PacerFT file transfer protocols. Users can open multiple windows and create simultaneous links to several hosts. Individual windows maintain their own parameters, so users can specify distinct terminal, connection and file-transfer types in each window. Using the program's HyperTalk-based scripting features, developers can build front ends to host systems and applications.

PacerTerm can be used over serial links or with a modem, and it supports both the LAT and TCP/IP protocols. The $245 software runs on the Mac Plus, Classic, SE, SE 30 and any Macintosh II with at least 1 megabyte of memory. PACER SOFTWARE INC., La Jolla, Calif.

Circle 551



THE METAVIEW SYSTEM for document image processing now supports Novell's Btrieve network server.

Getting The Metaview

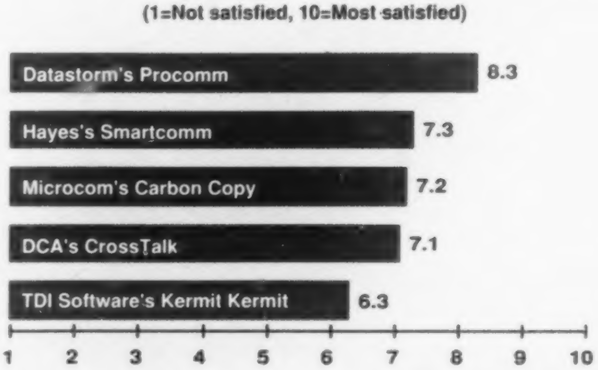
The Metaview system, an object-driven language for developing document image-processing systems across computing platforms, now includes support for Novell's Btrieve network server. Users can now download IBM AS/400 file descriptions using Metaview routines.

The start-up kit, which includes the Metaview Developers Workbench 2.2, the Metaview eXtended Operating System (MXOS), a display module and a midrange access program, is priced at $3,500. Additional modules for each workstation are priced at $1,200. METAFILE INFORMATION SYSTEMS INC., Rochester, Minn.

Circle 552

Corporate Satisfaction Scorecard: Communications

DATAMATION surveyed IS managers who have purchased PC communications software to determine their level of satisfaction. Procomm owners rated their purchases a full point higher than owners of the runner up—Hayes's Smartcomm.



Source: DATAMATION, December 1990

MARKET INSIGHTS

AN ANALYSIS OF ECONOMIC TRENDS

Consumers Won't Lead Recovery

BY MADELINE FRANCHI
Cahners Economics

In the face of rising unemployment and stagnating income growth, consumers slammed on the brakes earlier this year. On a seasonally adjusted basis, retail sales fell slightly from March to April 1991, nudging them a mere 1.7% higher than their level in April 1990. Take out the effects of inflation, and retail trade activity dropped a hefty 5% below last year's level.

For an explanation, look at the Conference Board's Consumer Confidence Index. Following the end of the Gulf War, consumer confidence rebounded from a deep drop. But the rebound was followed by another two-month decline. That fall in confidence also showed up in an uninterrupted four-month decline in installment credit.

As a result, for all of 1991, Cahners Economics expects only a 0.6% rise in retail sales. Factoring out inflation, that translates into a 3% decline in real terms.

Evidence of consumer cutbacks has started showing up in data on business failures in the retail trades. According to figures compiled by New York City-based Dun & Bradstreet Corp., 60,432 U.S. businesses closed up shop for good in 1990—the first increase in failures in three years. Retail trade concerns accounted for 21.2% of the failed companies. Between 1989 and 1990, the number of retail failures increased by 15.3%.

The upward trend continued into the first four months of 1991, too. During that time there were 35% more retail trade failures than there were in the first four months of 1990.

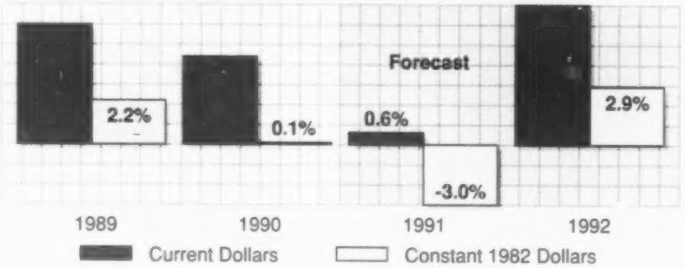
No surprise, then, that layoffs are also increasing in the retail sector of the economy these days. In every month since November 1990, the annualized level of employment has fallen. In April 1991, employment was 1.9% below that of April 1990. ☐

For more information on Cahners Economics's forecasting services, including seminars, newsletters and database diskettes, call Dan Buchan at (617)-630-2105, fax him at (617)-630-2100 or write to him at Cahners Economics, 275 Washington St., Newton, MA 02158.

So Much To Buy, So Little Money

Consumers squeezed every dollar this year...

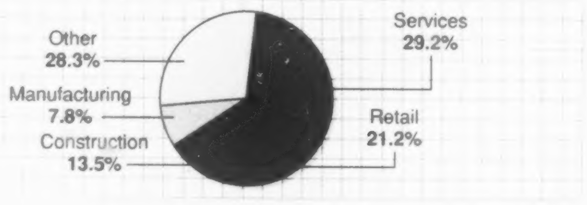
TOTAL RETAIL SALES (Annual % Change)



Source: U.S. Commerce Department

And businesses felt the pain.

U.S. BUSINESS FAILURES, 1990 (% Share Of Total)



Total: 60,432 failures

Source: Dun & Bradstreet Corp.

The Economy At A Glance

U.S. Economy: Macroeconomic And Industrial Indicators

	Actual		Forecast (Annual % Growth)		
	Q4/90	Q1/91	1991	1992	1993
Gross National Product	-1.6	-2.6	0.1	3.1	2.4
Business Investment In Equipment	6.3	-18.2	-1.0	4.6	4.9
Government Spending	4.7	-1.5	0.5	0.4	0.1
Consumer Spending	-3.4	-1.3	0.1	3.0	2.2
Exports	11.0	-2.6	2.8	5.1	3.1
Imports	-11.8	-11.3	0.5	4.3	1.8

All calculations are % change in 1982 dollars; quarterly figures are seasonally adjusted annual rates.

Manufacturing Production (1)	April 1991	March 1991	% Change 4/91-3/91	April 1990	% Change 1991-1990
Process Industries Total	97.2	95.0	2.3	108.0	-10.0
Chemicals	108.6	108.2	0.4	110.3	-1.5
Petroleum	106.5	108.6	-1.9	106.8	-0.3
OEM Total	108.4	107.6	0.8	112.5	-3.6
Computers & Peripherals	154.5	155.2	-0.5	149.3	3.5
Communication Equipment	111.9	109.9	1.8	107.6	4.0
Transportation Equipment	97.2	95.0	2.3	105.1	-7.5
Services Employment (2)					
Finance, Insurance, Real Estate	6.689	6.685	0.1	6.703	-0.2
Health Care	8.133	8.105	0.3	7.738	5.1
Computer & Data Processing	0.822	0.817	0.6	0.775	6.1
Transportation/Utilities	5.781	5.764	0.3	5.763	0.3
Retail Trade	19.093	18.990	0.5	19.457	-1.9
Wholesale Trade	6.062	6.063	0.0	6.187	-2.0
Government	18.761	18.774	-0.1	18.636	0.7

(1) Index 1978=100, seasonally adjusted
(2) Millions of persons, not seasonally adjusted

Source: Commerce Dept. and Cahners Economics

MARKET INSIGHTS

A SURVEY OF TECHNOLOGY TRENDS

MIS Says No To Network Outsourcing

BY WARREN CHILDS
Business Research Group

Although mainframe- and minicomputer-based host systems remain the dominant computing environments in large commercial MIS shops, PC local area networks are becoming increasingly important. LANs can boost processing power at a significantly lower cost and are thus taking on a central role in the development and implementation of strategic applications. Companies with geographically dispersed computing resources or newly implemented strategic applications are depending more and more on interconnected LANs to share data and processing.

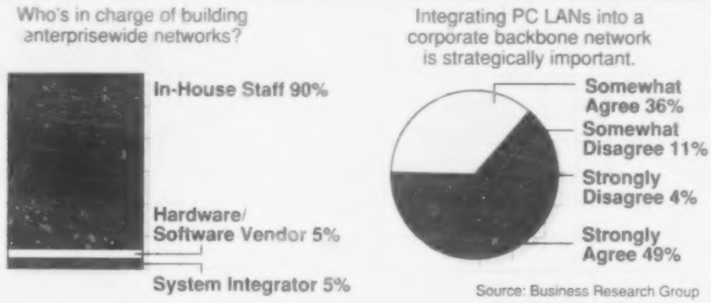
A recent survey conducted by the Business Research Group of more than 250 MIS managers at *Fortune* 1,000-sized companies reveals just how important LAN connectivity issues have become. Nearly half of those interviewed strongly agree that integrating PC LANs over a corporate backbone network is of strategic importance to their company. An additional 36% somewhat agree with that statement.

Despite the complexities, 90% of surveyed MIS managers are counting on their in-house staff to design and implement enterprisewide networks of interconnected LANs. Only 10% cite outsourcing to third parties such as hardware and software vendors, systems integrators and network service providers as the preferred route to interconnecting PC LANs.

BRG has identified a number of reasons MIS managers currently prefer not to go the outsourcing route for networking. In order of importance, MIS managers say they think outside service providers slow down project implementation, lack the business knowledge necessary to implement strategic applications, are too costly and may not have the necessary multivendor integration expertise. ▭

For more information, call Nancy Finn at (617)-964-6204, fax her at (617)-558-4402 or write to her at the Business Research Group, 275 Washington Street, Newton, MA 02158.

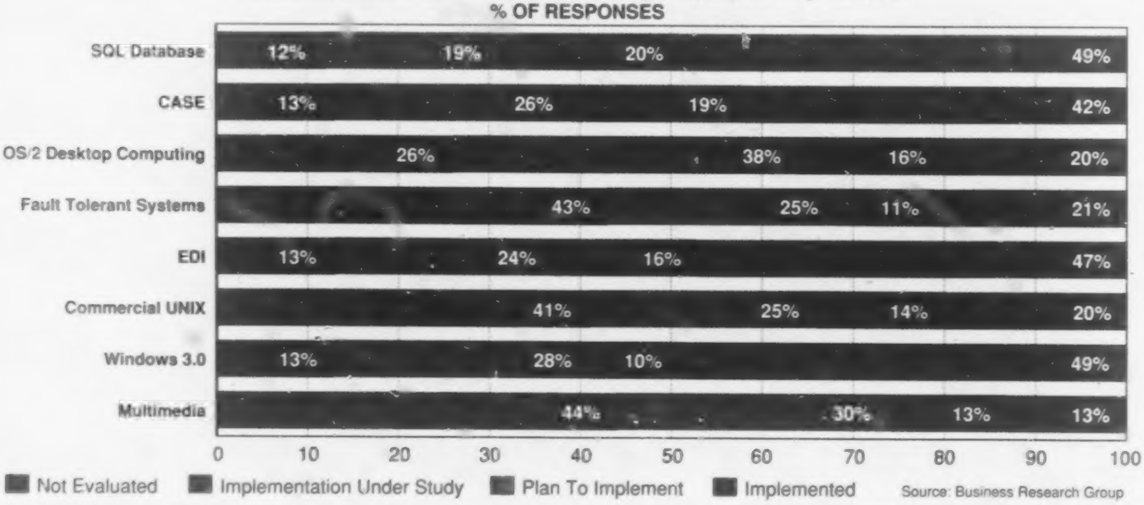
Who's King Of All The LANs? MIS!



Source: Business Research Group

DATAMATION's Technology Implementation Index: Systems And Software

DATAMATION each month surveys a select group of its readers--the DATAMATION Technology Panel--to investigate the implementation of new technologies by key user organizations.



Source: Business Research Group

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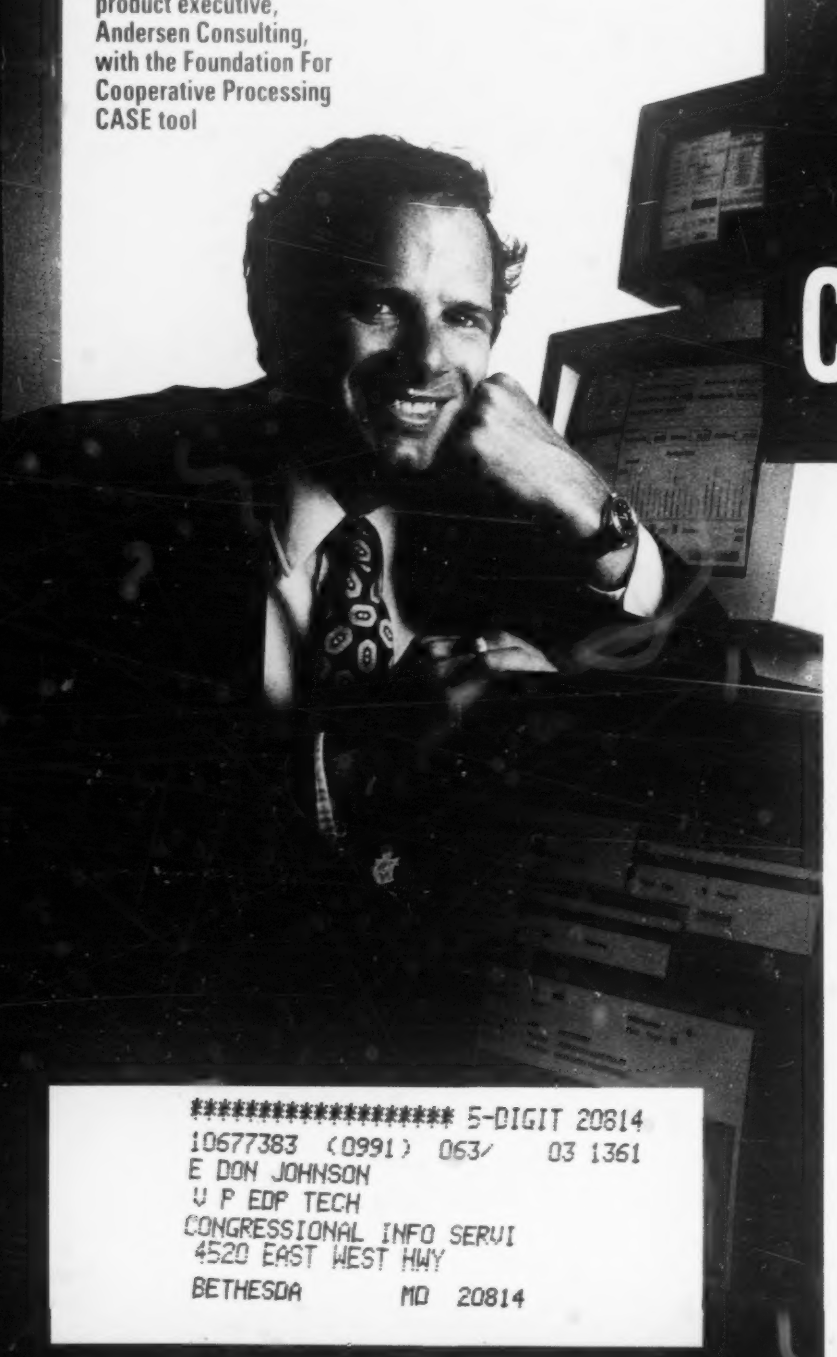

Glover T. Ferguson Jr., product executive, Andersen Consulting, with the Foundation For Cooperative Processing CASE tool

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VOLUME 37
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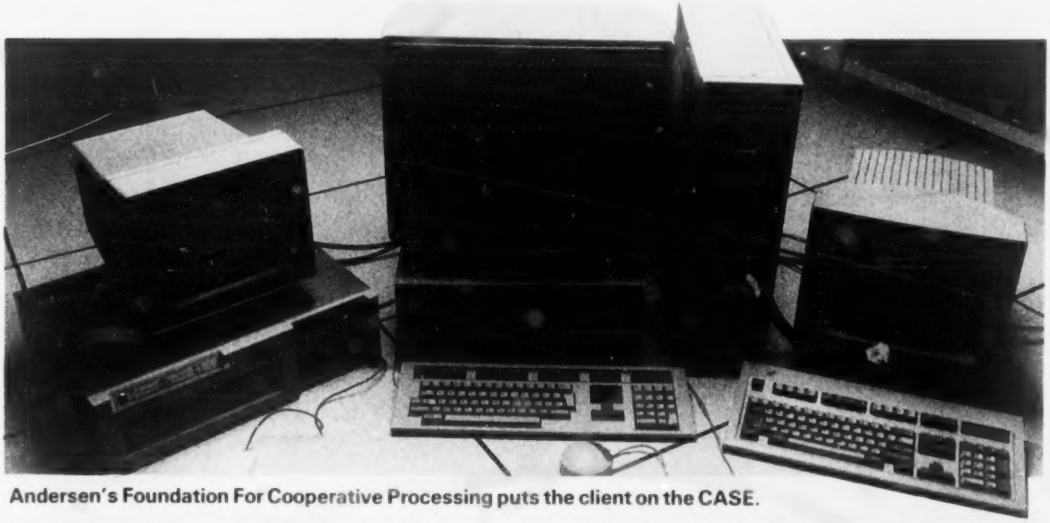

Andersen's Foundation For Cooperative Processing puts the client on the CASE.

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A CASE For Client/Server 28

BY MIKE RICCIUTI Andersen's Foundation For Cooperative Processing CASE product does what other CASE vendors only promise: designs and generates code for client/server applications.

Cover photography by Andy Goodwin

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Workstations Enter The Third Dimension 34

BY BOB FRANCIS Super chips at super prices are making 3-D workstations surprisingly affordable. Software interoperability remains a problem, but at these prices who wants a plain old workstation anymore?

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BY ELIZABETH LINDHOLM Lotus Development Corp.'s 1-2-3 For Windows provides a graphical interface, 3-D capabilities and complete backward compatibility.

Lotus's Stroube: Smart Icons know what part of the spreadsheet users are working with.

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BY TOM McCUSKER Now that Lotus and Microsoft are in the e-mail business, users can expect tighter integration of typical PC applications with messaging.

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Picking Client/Server Tools For LANs 47

BY PAUL PINELLA PCs and LANs have won the war as the de facto choice for many client/server applications. But, until the market matures, users must mix and match tools from among the scores that are now available.

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BY NED SNELL Long used for application development, methodologies are now being pushed for integration projects. But how well matched is the ordered world of methodologies to the anything-can-happen world of integration?

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BY JEFF MOAD After years of wrangling over specs for a proprietary CIM environment, Sematech has scrapped its plans in favor of standards-based computer-integrated manufacturing.

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Mixed Year For Asia's IT Industry

BY MARSHA W. JOHNSTON
A variety of economic factors made it a tougher year than usual for some Asian hardware vendors. But demand for software—all over the Far East—is heating up.

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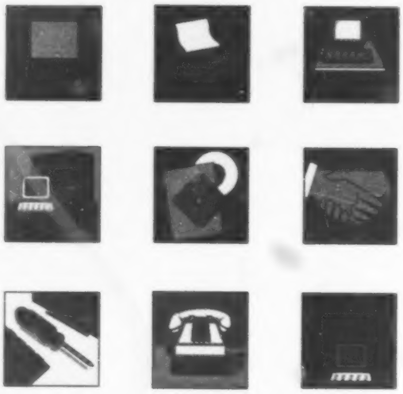

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PC Software Giants Move Into E-Mail

Now that Lotus and Microsoft are in the e-mail business, users can expect tighter integration of typical PC applications with messaging.

BY TOM McCUSKER

Early this spring, within a month of each other, software giants Lotus Development Corp. and Microsoft Corp. each gobbled up a vendor of electronic mail. Both said the move would strengthen their position in the groupware market. For users, the entrance of two PC application software heavies into e-mail bodes well for the further integration of messaging into networked desktop computing.

The companies are entering one of the hottest software arenas in commercial computing. LAN mailboxes, which only accounted for 26% of all e-mail boxes in 1990, is projected to skyrocket to 39% by 1994, says Ann Palermo, director of office systems research at International Data Corp. in Framingham, Mass.

Microsoft bought the assets of Consumer Software Inc., of Vancouver, British Columbia, Canada. Included in the deal was Consumer Software's PC-based e-mail service, called The Network Courier, which Microsoft wanted to complement its Microsoft Mail For AppleTalk Networks. Shortly after the acquisition was completed, the Redmond, Wash.-based PC software giant upgraded and renamed Network Courier as version 2.1 of Microsoft Mail For PC Networks. Microsoft says the product works on all major PC networks and desktop environments, including its Windows graphical environment.

Lotus Enters The E-Maelstrom

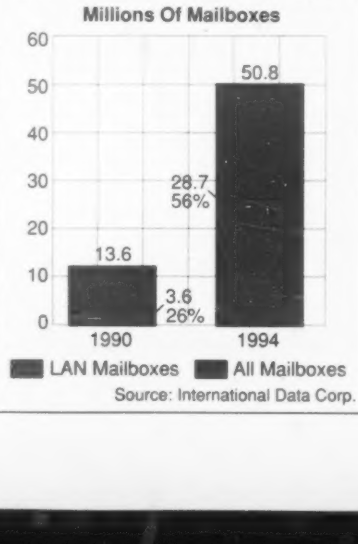
Microsoft's acquisition followed Lotus's March 1991 purchase of cc:Mail Inc. of Mountain View, Calif. Lotus's motive: it simply wanted to be in the e-mail business. "With this acquisition, Lotus establishes itself as the leading vendor in LAN-based communications software," says Jim Manzi, the Cambridge, Mass.-based company's president and chief executive officer.

Cc:Mail has captured 35% of the LAN e-mail market, and Lotus envisions cc:Mail as an avenue through which to sell its widely acclaimed three-year-old Notes group communications product (see "IS Puts Notes To The Test," August 1, 1991, p. 24). It thus is integrating the underlying architectures of cc:Mail and Notes. Lotus sells its Notes product with built-in e-mail. But, under the integration scheme, there will be a common Lotus messaging architecture, says Shelley Harrison, director of marketing at cc:Mail, which now operates as a division of Lotus.

Lotus also announced an agreement in June with IBM to integrate both cc:Mail and Notes with IBM's OfficeVision suite of office automation software. OfficeVision/2, the version for PCs running the OS/2 operating system, will share a common messaging engine with the two Lotus programs. This would spare OfficeVision/2 users of Notes from having to use multiple e-mail systems, as well as give them the ability to use Notes's groupware functions.

LAN E-Mail Is Growing More Than 50% Yearly

The number of LAN mailboxes is expected to increase at a compound annual rate of 68% until 1994, when most mailboxes will be on LANs.



Source: International Data Corp.

IDC's Palermo says the deal is significant in two respects. First, agreement among Lotus, cc:Mail and IBM to use a common directory and mail engine puts the status of Novell Inc.'s Message Handling System as an emerging de facto standard in question. MHS could be further weakened if Microsoft decides to push a third standard. Second, the Notes/OfficeVision connection means that developers will be able to write OV applications that include unstructured information. And they'll be able to write to the Notes back-end database manager without using Notes's interface.

Microsoft's Mail Moves

Microsoft says it expects to begin shipping a Microsoft Mail connection this month that will link Microsoft Mail For AppleTalk Networks and Microsoft Mail For PC Networks. Previously, the two products were incompatible. Mail For AppleTalk is a client/server product, whereas the Network Courier was a file-based system. Microsoft product manager Kathleen Schoenfelder says the connection will enable users on both mail systems to exchange directories, messages and files seamlessly.

Microsoft's next move is to exploit the messaging transport function of e-mail. Schoenfelder likens the messaging transport to a layer on the network in the way that a network operating system is a layer. Microsoft already has an extensive application programming interface for the Macintosh called the Mail API (MAPI).

A more limited API—the File Format API (FFAPI)—exists for PCs, but Microsoft will release a PC version of MAPI in the near future.

Microsoft's own applications will probably be mail-enabled in the next upgrade after MAPI is released, says Schoenfelder. That might, for example, take the form of including Open Mail and Send Mail commands within word-processing or spreadsheet applications.

"We are also creating other work group applications that ride on top of the e-mail network," she adds. These include calendar and scheduling applications that already have been released on Microsoft's AppleTalk system. "Freestanding applications, such as Lotus 1-2-3, Excel and Word, as well as any kind of work group application written specifically for networking environments, will be able to tap into the network's e-mail transport system," she adds.

"Nineteen ninety-two will be a very interesting year in the e-mail industry," concludes Schoenfelder, as e-mail and other networked applications begin to act synergistically. ▭

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ASIAN 25

Mixed Year For Asia's IT Industry

A variety of economic factors made it a tougher year than usual for some Asian hardware vendors. But the demand for software—all over the Far East—is heating up.

BY MARSHA W. JOHNSTON

Far East investment growth in information technology isn't racing ahead on high-speed rails. But a variety of factors, including the Japanese labor shortage, government initiatives in Korea, a new Taiwanese PC OEM business and voracious industrialization in Southeast Asia should keep the engine of investment in IT chugging along nicely in the coming months.

This is not to say potential roadblocks to growth in the industry don't exist. Once-brisk capital spending could be further dampened in Japan, due to a confluence of factors. Those factors include high interest rates, falling real estate prices, weak stock market performance and a tightening money supply.

Roadblocks in Korea and Taiwan include continuing appreciation of the won and the New Taiwan dollar, along with rising wages and inflation. In Korea, continuing political unrest could stand in the way of business growth in general. And none of this takes into account the continued U.S. recession or the slump in the worldwide computer industry.

Where The Growth Is

The fastest growth in Asia lies in the PC and peripherals sectors.

RANK	COMPANY	PC REVENUE 1990	1989	% CHANGE
1	Daewoo	121.7	87.2	39.6%
2	Ricoh	373.0	287.5	29.7%
3	Acer	488.0	377.8	29.2%
4	Mitac	229.5	178.6	28.5%

RANK	COMPANY	PERIPHERALS REVENUE 1990	1989	% CHANGE
1	Daewoo	16.2	11.1	46.0%
2	Acer	118.0	92.3*	27.8%
3	Ricoh	559.5	438.7	27.6%

All revenue figures are in $ millions, based on fiscal year results.
* Restated figure

Japan: Sun Rises On Software

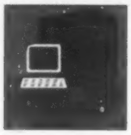
A recent report issued by Japan's Ministry of International Trade and Industry (MITI) estimated that total capital spending in Japan will rise only 9.2% in fiscal year 1991 (ending March 1992), the first time in four years that capital spending growth will be less than 10% and far below FY90's 17.5% rate.

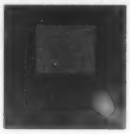
Few figures are available to indicate the percentage of total private-sector capital expenditure devoted to IT. But Takatoshi Yamamoto, senior analyst at Morgan Stanley in Tokyo, says it probably registered at 11% for FY90, down about 1% from FY89.

This fiscal year, overall spending on IT in Japan should grow slightly, analysts say, as Japanese corporations automate to mitigate the negative effects of a severe labor shortage. MITI's report says that almost three-quarters of the 1,521 Japanese firms surveyed view the shortage as a "serious structural problem," which will cause them to "continue to invest strongly in energy-saving and streamlining measures."

Junichi Saeki, research manager for Dataquest Japan Ltd.'s research group, and Alan Bell, deputy head of research for Baring Securities Ltd. in Tokyo, agree that this trend should increase spending on computers and networks slightly this year. "Spending on IT systems will be moderately positive...flat to plus four [percent]," says Bell.

According to estimates from analysts and MITI, much of that growth will come from PCs, software, systems integration and local area networks; little will be derived from large systems. Over the next five years, hardware growth potential should be only about 1 to 2% for mainframes, but in the double digits for PCs and smaller products, says





Morgan Stanley's Yamamoto. His estimates are backed up by one Digital Equipment Corp. Japan executive, who says sadly, "Things have been slow. People have been putting off making $1- to $2-million purchases."

One reason for the flat growth in large systems is high interest rates. High borrowing costs, combined with a tightening money supply, could be the biggest inhibition to corporate spending on IT, say analysts, particularly if these factors are combined with low business confidence.

The average interest rate on bank loans rose to 7.68% in March 1991 from 6.21% in February 1990. In June, the Bank of Japan's (BOJ) quarterly survey of companies, the Tankan, showed the economy slowing and business confidence declining. On July 1, the Bank of Japan responded to a call for lower interest rates by cutting the discount rate—the rate the BOJ charges its member banks—half a percent to 5.5%, still a quarter percentage point higher than it had been the previous year.

Economic analyst Douglas Ostrom of the Japan Economic Institute in Washington, D.C., says the cut was not enough to spur demand. Furthermore, Ostrom says, banks are lending more cautiously as they gear up to meet new worldwide lending regulations that will come into effect in March 1993. And lenders have also grown more cautious in the face of Japan's overvalued real estate market.

The tightening money supply does not seem to have affected investments in software, which generally comes with much lower price tags than do large-scale systems. In fact, customers from all over Asia, including Japan, are buying software voraciously. MITI forecasts 15 to 16% growth for the software market for FY91, including packaged and custom-developed software. In addition, spending on LANs is up dramatically, says Baring's Bell, who says it grew 30% in FY90. He estimates it will increase by the same percentage in FY91.

Companies buying software need help implementing it and linking a wide variety of systems and software together—creating a significant need for professionals with systems integration expertise. Vendors are only too happy to comply. Some systems integrators, such as Arthur Andersen, have been working in Japan for a few years, but between 1989 and 1990 there was a surge of systems integrators entering the market. In that period, says Dataquest's Saeki, about 100 companies, mostly Japanese software developers, declared themselves system integrators. This May, General Motors Corp.'s giant systems integrator/outsourcing company Electronic Data Systems Corp. joined the fray.

As Japanese businesses begin to move away

The DATAMATION Asian 25

	1989 ASIAN RANK	1990 WORLD RANK	COMPANY	1990 IS REVENUE	1989 IS REVENUE	% CHANGE***	1990 TOTAL REVENUE	IS AS % OF TOTAL REVENUE	NET EARNINGS	FISCAL YEAR
1	1	3	Fujitsu**	14,196.2	12,245.8*	15.93%	20,521.1	69.18%	571.1	March
2	2	4	NEC	13,407.5	12,733.5*	5.29%	25,544.2	52.49%	375.6	March
3	3	5	Hitachi	9,604.1	8,961.2*	7.17%	53,432.1	17.97%	1,589.7	March
4	4	13	Toshiba	5,169.2	4,842.9*	6.74%	22,444.8	23.03%	759.7	March
5	6	15	Matsushita	4,101.8	3,915.6*	4.75%	45,575.3	9.00%	1,788.1	March
6	5	14	Canon	4,040.1*	3,390.0*	19.18%	11,933.3	33.86%	424.1	December
7	7	27	NTT Data	2,382.0	2,218.5*	7.37%	2,382.0	100.00%	87.7	March
8	11	34	Ricoh	2,331.3	1,862.1*	25.20%	6,928.6	33.65%	93.6	March
9	8	25	Nihon Unisys	2,241.4	2,071.8*	8.19%	2,241.4	100.00%	13.9	March
10	10	29	Oki	2,086.8	2,087.3*	-0.02%	4,564.4	45.72%	68.1	March
11	9	28	Mitsubishi	1,830.1	1,662.6*	10.07%	22,902.2	7.99%	550.8	March
12	13	39	C. Itoh	1,595.1	1,345.9	18.52%	145,011.5	1.10%	242.6	March
13	12	40	Seiko Epson	1,590.7	1,449.5	9.74%	2,913.4	54.60%	N/A	December
14	15	64	Acer	751.0	551.1*	36.27%	949.0	79.14%	2.4	December
15	20	113	Nomura	652.3	675.2*	-3.40%	963.5	67.70%	51.6	March
16	N/A	68	Tatung	593.4	580.0	2.30%	1,877.9	31.60%	11.0	December
17	14	76	CSK	527.2	495.1*	6.49%	553.9	95.18%	32.8	September
18	19	101	Sony	499.5	417.4*	19.66%	24,975.9	2.00%	807.5	March
19	18	94	Kyocera	480.0	482.9*	-0.61%	3,185.3	15.07%	222.7	March
20	17	91	Mitac	450.0*	380.0	18.42%	450.0	100.00%	23.2	December
21	21	107	Intec	402.7	356.9	12.84%	402.7	100.00%	16.5	March
22	N/A	N/A	Goldstar	391.0	365.3	7.04%	4,216.1	9.27%	47.5	March
23	16	98	Alps	384.1	398.7	-3.64%	3.190.6	12.04%	57.0	March
24	N/A	N/A	Omron	291.3	265.4	9.78%	3,207.0	9.08%	148.3	March
25	22	56	Daewoo	200.2	195.6	2.38%	298.1	67.16%	4.8	December

Figures are in $ millions.

World rank based on CALENDAR YEAR 1990; Asian rank based on individual company's fiscal year.

N/A = Not available

*Restated figure

**Fujitsu includes 80% of four months of ICL's revenues.

***Revenue growth figured on a dollar basis in the table, but on the basis of native currency in the profiles.

from their traditional tendency toward centralization, Japanese users are buying more notebook computers than are their foreign counterparts. Indeed, Toshiba Corp. says its notebooks accounted for 70% of its domestic laptop sales in FY90 but only 48% of its laptop sales outside Japan. Indeed, analyst Bell says, notebooks are having as much or more of an impact on the Japanese market as laptops did when they were first introduced.

Korea: Government Pushes IT

In FY90, South Korean purchasers bought $1.7 billion worth of IT equipment, a whopping 31% more than they did the year before. Much of that investment came from the country's huge family-run conglomerates, or chaebols, which dominate Korean industry. With mammoth corporate populations and projects to support, chaebols buy a lot of mainframes and midrange systems. "It's a high-end market because of Korea's large companies," says Joseph B. C. Sweeney, regional production manager for ResearchAsia Ltd. in Hong Kong.

One factor promoting such rapid growth is strong government support for IT investments. South Korea has an ambitious strategy to computerize not only the chaebols but smaller businesses, schools and the military.

Among the Korean government's several IT projects is its three-year-old Five Network Plan, which intends to create national networks for a variety of industries. In the next seven years, for instance, the government plans to install millions of PCs into schools as part of a monolithic educational network.

And Korea is not only implementing systems and networks, it's making research and development efforts, as well. For instance, the government will soon complete development of Ticom, a prototype of a UNIX-based minicomputer with Korean-language capability. South Korean administrators expect the chaebols to use the prototype to create marketable products. But such a project may prove too difficult even for Korea's largest computer makers.

Although about four of the chaebols have publicly stated they will follow through on their Ticom commitment, in general, the chaebols have doubts about the project's worth, says ResearchAsia's Sweeney. No chaebol will buy from another, he maintains, and thus a company's Ticom market would be limited to itself and its associated companies. The overseas market, already crowded with UNIX mini makers, won't be fertile ground for Ticom, either. Furthermore, says Sweeney, "I don't think they [the chaebols] have the right skills to sell that product overseas, and I don't think they think they have the right skills."

The DATAMATION Asian 25 By Technology

	COMPANY	1990 IS REVENUE	MAIN-FRAME	MID-RANGE	PCs	WORK-STATIONS	SOFT-WARE	PERI-PHERALS	DATA-COM	SERVICES	MAINTE-NANCE	OTHER
1	Fujitsu*	14,196.2	3,691.0	1,419.6	1,419.6	142.0	2,129.4	2,129.4	283.9	1,135.7	993.7	851.8
2	NEC	13,407.5	2,815.6	1,743.0	3,620.0	134.1	1,340.7	1,877.0	268.1	402.2	536.3	670.4
3	Hitachi	9,604.1	3,418.5	398.6	718.4	192.1	798.1	2,831.5	386.7	259.3	244.3	356.6
4	Toshiba	5,169.2		1,125.7	2,488.3	216.2		727.2	207.2			404.7
5	Matsushita	4,101.8			164.1	902.4		1,763.8	1,025.4		246.1	
6	Canon	4,040.1			426.8			2,399.8		963.7		249.7
7	NTT Data	2,382.0							1,429.2	952.8		
8	Ricoh	2,331.3			373.0		116.6	559.5	1,049.1		116.6	116.6
9	Nihon Unisys	2,241.4	872.0	125.6	118.0	82.3	541.3				252.6	249.6
10	Oki	2,086.8		83.5	93.9		156.5	1,210.4	354.8		187.8	
11	Mitsubishi	1,830.1	146.4	420.9	201.3			603.9	457.5			
12	C. Itoh	1,595.1				558.3	111.7	733.8	63.8	127.6		
13	Seiko Epson	1,590.7			636.3			954.4				
14	Acer	751.0			488.0	135.0		118.0			10.0	
15	Nomura	652.3								652.3		
16	Tatung	593.4			150.2			300.5	142.7			
17	CSK	527.2		96.7			430.5					
18	Sony	499.5				75.0		424.5				
19	Kyocera	480.0			51.8			276.2	151.9			
20	Mitac	450.0	13.5	9.0	229.5	9.0	4.5	148.5	13.5	18.0	4.5	
21	Intec	402.7					154.8		54.1	111.5		82.3
22	Goldstar	391.0		39.1	195.5			156.4				
23	Alps	384.1						384.1				
24	Omron	291.3			167.9	36.7		86.8				
25	Daewoo	200.2	8.8		121.7	14.5	30.7	16.2	4.0	0.6	3.5	0.3

Revenue figures are in $ millions for fiscal 1990.
*Fujitsu includes 80% of four months of ICL's revenues.
Technology segment totals may not add up to total revenue due to rounding.

But Korean companies can successfully sell PCs overseas, particularly into newly developing parts of Asia like Indonesia. For the most part, Korean firms such as Goldstar Co. Ltd. assemble PCs in Indonesia and then sell them under Indonesian brand names, maintains Sweeney.

Tough Times For Taiwan

Taiwan's IT industry has historically concentrated on low-margin, low-end products for export; more than 90% of Taiwanese-made electronics products were exported last year. This strategy worked to Taiwan's detriment in 1990, as a worldwide crunch in PC prices and a strong New Taiwan dollar combined with the country's rising labor costs and inflation rates to severely undercut the profitability of Taiwanese IT vendors. Acer Inc., Taiwan's largest IT company, suffered a 59% drop in profits.

Foreign Exchange

Values of foreign currency (equivalent to one dollar) used in this year's DTM 100*.

JAPAN	¥144.8
SOUTH KOREA	W707.76
TAIWAN	NT$26.63

*OECD average exchange rates

"There are very few Taiwanese companies adding value to their products. They have always survived on relatively low margins, so where U.S. and European companies have had to drop their margins significantly, Taiwanese companies didn't have much profit margin to drop," says David Hoffman, technology practice manager at Investec (Taiwan) Ltd., a marketing consultancy.

These problems have caused an incredible consolidation of PC dealers in Taiwan. Dealerships in the island nation now number 600, down from 2,000 two years ago, Hoffman reports. Increasingly, the savvy surviving dealers are selling software along with hardware and realizing higher revenues as the prices of such value-added bundled systems climb. Revenues are increasing drastically, Hoffman maintains, despite the fact that unit sales have declined.

Most of these dealers are adding value with little help from vendors. For instance, Hoffman says, most manufacturers have failed to recognize the fact that Taiwanese dealers "are just learning how to integrate applications and consult end users on what they want to buy." Apple Computer, he says, is the only major exception among the vendor community; the Macintosh marketer is actively training Taiwanese dealers to add value.

Manufacturers are, however, responding to lower profit margins by attempting to market more advanced workstations and laptop computers, which have the potential to garner higher profit margins. A report by the Market Intelligence Center of the Institute of Information Industry, a government-sponsored market research agency, states that by 1990 about 200 Taiwanese firms had started to manufacture portable PCs.

One piece of good news for Taiwanese PC makers: Investec reports an influx of first-time original equipment manufacturer (OEM) business from companies like NCR Corp., which are buying Taiwanese computers and reselling them under their own brand names.

Southeast Asia: Engine Of Growth

Heavy investment in software, services and communications is one factor fueling the rapid growth of the IT industry in Southeast Asia. "People here are beginning to realize that software and services are more important than hardware, so we're seeing a boom in [those] sales," says ResearchAsia's Sweeney. In Indonesia, which ResearchAsia says is the fastest growing Asian market for IT, 1991 revenue growth in software and services is projected at about 46%. ResearchAsia predicts hardware revenues will grow at about 27% in 1991.

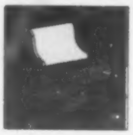
But that's from a small base of installed information technology equipment—particularly software, says Sweeney. As software installations catch up to hardware implementations over the next five years, he says, the rate of growth in software and services will slow to that of hardware.

The stars of hardware growth in the region, as elsewhere in the world, are workstations and PCs. Strong growth in workstations in most countries is likewise due in large part to a small installed base in countries like Indonesia. And Sweeney is not confident that this trend will continue. "I believe this very quickly will peter out, however, because Indonesia, like Thailand, has a very strong agricultural industry, and workstations tend to be sold into economies with strong manufacturing bases," he says.

As purchasers snap up PCs and workstations, particularly in developing countries like Malaysia and Thailand, they are also choosing PC LANs. But most users there don't understand how to get a PC LAN to work. "Many software houses don't know how to tune a LAN. [They] say, 'We can put in a LAN, and your PCs will run better,' so the user thinks the programs will run faster and the PCs will share data, but it doesn't happen," says Sweeney. Consequently, there is a huge, unfilled market for LAN specialists in Southeast Asia.

"Huge" is also a good way to describe the market for telecommunications in the region. In August, the Thai government awarded a deal worth between $2.4 billion and $2.86 billion to the local Charoen Pokphand Group to install 2 million new telephone lines in the Bangkok area.

Obviously, says Sweeney, Southeast Asia is no longer just a cheap labor market, but "has gotten to be a rich area of the world and a complex and sophisticated IT market." ▭



FUJITSU LTD.

6-1 MARUNOUCHI 1-CHOME
CHIYODA-KU, TOKYO 100, JAPAN
(81-3)-216-3211

RANK
1
IS REVENUE
$14.20 B

The bad news for Asia's largest vendor of information technology was that, as 1990 wore on, rising interest rates at home and a worldwide recession combined to depress demand and put pressure on earnings. The good news was that, unlike IBM and other major competitors, Fujitsu Ltd. in 1990 still had plenty of room to grow in major European and North American markets. Last year, Fujitsu cashed in on that growth opportunity by acquiring 80% of International Computers Ltd., a $2.7 billion U.K.-based mainframe vendor and long-time Fujitsu partner.

The ICL acquisition helped boost Fujitsu's total sales in fiscal 1990, which ended March 1991, by 16.5% to ¥2.97 trillion ($20.5 billion). The computer and data-processing equipment product set—which spans supercomputers to PCs—was the company's fastest growing segment. Its revenues in yen terms increased 21.7% to ¥2.06 trillion ($14.2 billion), or 69% of Fujitsu's revenue.

Despite revenue growth in many sectors of the company, intense international competition and a strengthened yen combined to drive down Fujitsu's net earnings by 4.7% to ¥82.7 billion ($571.1 million). Fujitsu officials say they expect continued slow economic growth worldwide to keep a lid on sales in fiscal 1991.

In the face of sluggish sales in existing markets, Fujitsu is continuing the push to expand internationally. The ICL acquisition helped increase Fujitsu's overseas business about 2% to 24.8% of the company's total 1990 revenue. Fujitsu officials predict overseas sales will jump to 40% of the company's revenue in FY91, when ICL results will be included in Fujitsu's financial statement for the full year. (Since the Fujitsu/ICL deal took place on December 1, 1990, Fujitsu included in its FY90 results 80% of ICL's income from December to March 31, 1991.)

Tough economic conditions didn't keep the company from launching several key products in 1990. Fujitsu introduced a high-end extension to its M-series Facom mainframe line. The new M-1800 group competes with IBM's ES/9000 class of mainframes.

Fujitsu also unveiled several enhancements to its VP 2000 series of supercomputers. The largest, the VP2400/40, will begin to be shipped this month.

Less successful were Fujitsu's ongoing efforts to become a force in personal computer sales in Japan. Although the company continued to enhance its two-year-old FM Towns line of DOS-compatible PCs, the company failed to gain market share. In 1990, Fujitsu held 13.7% of the Japanese PC market, according to the *Japan Industrial Daily*, about the same as it held the year before, when it introduced FM Towns. That figure was far behind NEC Corp.'s leading 50% share.—*Jeff Moad*

NEC CORP.

5-7-1 SHIBA 5-CHOME
MINA[illegible]-KU
TOKYO 108[illegible]1, JAPAN
(81-3)-3798-6511

RANK
2
IS REVENUE
$13.41 B

This was a year of innovation and expansion for NEC Corp. The ¥3.7 trillion ($25.5 billion) company made significant mainframe and personal computer product announcements and broadened its European marketing efforts.

Innovation has apparently paid off for NEC: IS revenues climbed almost 11% to ¥1.9 trillion ($13.4 billion) in fiscal year 1991. Employment is up, too. In a year when most computer companies cut their work forces, NEC added another 2,000 employees.

Net earnings, however, suffered a drop of 36% to ¥54 billion ($375.6 million) due largely to losses incurred from the company's withdrawal from the audio-visual business in the United States, weakened business performance in semiconductor subsidiaries and lower earnings from affiliated companies.

In July of 1990, NEC announced what it billed as the "world's fastest mainframe computer." However, that title didn't last long for the 500-million-instruction-per-second ACOS 3800. NEC outdid itself with the March 1991 announcement of the ACOS 3900, which clocked speeds of up to 700MIPS. The company expects to sell more than 200 of the ACOS machines by 1995, but analysts doubt the systems can boost NEC's market share, as they are not IBM compatible. NEC has approximately 2% of the high-end U.S. mainframe market and 8% of that sector in Japan.

The company's creativity extended from the most powerful mainframes down to the most miniature of its systems. The company announced in Japan this year its Handy98, a 1.1-kilogram (2.4-pound) computer. The 10-megahertz system is about half the size of other notebook computers and comes bundled with Microsoft Corp.'s MS-Works software. The company also announced a color notebook in its 9800 series, priced at ¥650,000 ($4,460), about half the price of most color notebooks. Finally, with an eye on the growing number of telecommuters in Japan, the company added a radio frequency modem to its traveling notebook. NEC now has more than 25 models in its 9800 line of personal computers and about half of the market in Japan.

Preparing for the local area network market to boom in Japan as it has in the United States, NEC joined forces with Mitsubishi Corp. and Otsuka Shokai, NEC's largest Japanese distributor, to form Networld, a distributor of LAN-related products. NEC also gave away its Japanese version of Microsoft's Windows 3.0 to developers. That move was intended to counter an IBM-led consortium of seven companies developing competing PCs based on an open standard for the Japanese market.—*Tom Wood*

HITACHI LTD.

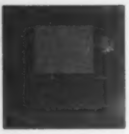
6 KANDA-SURUGADAI 4-CHOME
CHIYODA-KU, TOKYO 101, JAPAN
(81-3)-3258-1111

RANK
3
IS REVENUE
$9.60 B

Hitachi Ltd. is a company that has to think smaller in order to grow. The company's traditional strengths in the supercomputer, mainframe and workstation markets helped boost its information technology revenues an estimated 12.5% to ¥1.39 trillion ($9.6 billion) in fiscal 1990, which ended in March of 1991. But Hitachi remains an also-ran in fields such as systems integration, PCs and notebook computers—the major growth areas in the Japanese computer industry.

In June 1990, Hitachi introduced its M-880 mainframes, which it claimed at the time were the world's fastest. Breaking old habits, Hitachi announced its entry into the new generation of mainframes before rivals Amdahl Corp., Fujitsu Ltd. and IBM, underscoring how the company has jettisoned its "follower" role. Analysts don't expect IBM's dominance of the market to change overnight, but the M-880 series marks the beginning of a long-term assault on Big Blue. In fact, Hitachi Data Systems Corp., a mainframe distributor set up two years ago by the Japanese firm and Electronic Data Systems Corp., grew during 1990 on the strength of Hitachi's fast new mainframes.

Hitachi remains strong in the midrange section of the computer market. The company has an 80% share of the market in stockbrokers' dealing stations in banks and securities firms in Japan, and customer loyalty



should ensure its continued dominance in this sector. However, analysts note that Hitachi is weak when it comes to designing engineering workstations.

"Hitachi is putting more effort into designing workstations," says Junichi Saeki, research manager of Dataquest Japan's information systems group. Saeki adds that the firm has a wealth of in-house software design experience and hence an impressive potential for software development. Meanwhile, following up its July 1989 agreement with Hewlett-Packard Co. to codevelop reduced instruction set computing (RISC) chips for workstations, Hitachi recently announced that the two firms will introduce a 32-bit workstation by early 1992.

This past May, Hitachi made two attempts to increase its profile in the PC market, with the 32-bit Flora PC and the With Me word processor. The With Me machine is reported to be selling well, although Hitachi has yet to release official sales data for the two new products. Hitachi and HP are jointly developing a new workstation that will incorporate a microprocessor operating at 100 million instructions per second (MIPS). Hitachi is expected to unveil the workstation late this year or early next year.

In February 1991, Hitachi set up Hitachi Computer Products Europe SA, a manufacturing company in Orleans, France, in anticipation of the European Community's 1993 market integration. Production of magnetic disk drive systems and control equipment is set to get under way in May of 1992. Hitachi expects the 170-person company to rack up Fr550 million ($101 million) in 1992.—*Steve McClure*

TOSHIBA CORP.

1-1- SHIBAURA 1-CHOME
MINATO-KU, TOKYO 105-01, JAPAN
(81-3)-3457-2104

RANK
4
IS REVENUE
$5.17 B

Despite thinner profit margins on personal computers and semiconductors, Toshiba Corp. displayed an aggressive attitude toward new product development, new marketing relationships and plant expansion in 1990 and into 1991.

As a result, the company's information systems revenues reached nearly ¥749 billion ($5.17 billion) in the 12-month period ending March 31, 1991. The figure represents a 12% gain from Toshiba's previous fiscal year. Overall corporate revenues for Toshiba increased 6% in FY90 to ¥3.25 trillion ($22.4 billion).

Price cutting in PCs and in 1-megabit dynamic random access memory (DRAM) semiconductors took their toll on Toshiba's profits, which fell almost 50% during the fiscal year. An increase in interest and other income, however, salvaged the company's bottom line: net earnings rose 13.6% to ¥110 billion ($760 million).

Marketing battles in personal computers have been fiercest in the U.S. In response to market conditions, Toshiba slashed PC prices as much as 33% earlier this year, and it scaled back PC production plans in the United States.

However, the heat of such battles didn't keep Toshiba from introducing new IS products. In November 1990, the company unveiled three notebook PCs based on Intel Corp.'s 80386SX chip and a new laptop PC.

Toshiba also introduced reduced instruction set computing (RISC) into its laptop line. In May 1990, the company unveiled the SPARC LT, a 17.7-pound portable engineering workstation operating at 13 million instructions per second (MIPS). Possibly because of its ¥2 million ($13,812) price tag, Toshiba sold only 2,300 of the units in its first year on the market—far below the 12,000 models it expected.

In June 1991, the firm introduced a voice/data private branch exchange (PBX) in the United States and started shipping, through a joint venture, local area network operating systems software in Japan.

—*Marsha W. Johnston*

MATSUSHITA ELECTRIC INDUSTRIAL CO. LTD.

1006 OAZAKADOMA
KADOMA-SHI, OSAKA-FU 571, JAPAN
(81-6)-908-1121

RANK
5
IS REVENUE
$4.10 B

Consumer electronics giant Matsushita Electric Industrial Co. Ltd., spent 1990 continuing its efforts to squeeze into the small systems computer market. The company abandoned its mainframe-manufacturing effort in 1964 and only reentered the commercial market in the last few years. As a relative latecomer to IS, Matsushita has chosen to enter markets quickly through joint ventures. So far, the strategy appears to be successful. Matsushita can offer partners its worldwide sales and marketing resources using the Panasonic and National brand names, among others.

Last year, Matsushita signed agreements with two worldwide computer firms. In a deal signed with Mountain View, Calif.-based Sun Microsystems Inc., Matsushita gained marketing rights to Sun's workstations in exchange for access to that company's UNIX operating system and Scalable Processor Architecture (SPARC) chips. Another agreement signed with Munich-based Siemens Nixdorf Informationssysteme AG granted Matsushita the right to sell SNI's desktop computers in Japan, with SNI selling Matsushita's laptops in Europe under the Panasonic label.

In late 1989, Matsushita signed similar agreements in the U.S. market with PC maker Tandy Corp. and Sequent Computer Systems Inc. Under the Tandy agreement, Tandy manufactures both 16- and 32-bit desktop PCs for Matsushita for sale under the Panasonic label. Similarly, 8-bit laptops that are manufactured by Panasonic in Japan are sold in the United States under both the Panasonic and Tandy labels. Meanwhile, the agreement with Sequent allows Matsushita to sell Sequent's line of superminicomputers in Japan.

Despite Matsushita's overseas ventures, the domestic Japanese market remains critical to the company's success. About 55% of sales are made in Japan. The company has been successful in diversifying its market focus from consumer to business sales, however. Today about half of its sales are to business users.

All of Matsushita's IS business is found within the company's Communication and Industrial Equipment division. This division, the second largest and fastest growing division in the company, includes office automation equipment, communications equipment and a wide variety of industrial systems. In the fiscal year ending March 1991, division sales reached ¥1.533 trillion (about $11 billion)—an increase of 13% over the previous year's level. DATAMATION estimates that almost 40% ($4.1 billion) of this division is IS. The company as a whole showed a revenue increase of almost 10%.

—*Johan Hallsenius*

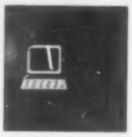
CANON INC.

DAI-ICHI SEIMEI BUILDING
7-1 NISHI SHINJUKU, 2-CHOME
SHINJUKU-KU, TOKYO 163, JAPAN
(81-3)-3348-2121

RANK
6
IS REVENUE
$4.04 B

Office equipment maker Canon Inc. continued its thrust into the computer business last year. The company, which analysts say controls over 70% of the world's laser printer market, ramped up production of its Bubble Jet printer line last year. Among Canon's many original equipment manufacturer (OEM) customers is Apple Computer Inc., which snapped up the printers for its Macintosh family.

Canon intends to focus more on IS for the



rest of the decade, both through its own efforts and through joint partnership arrangements. Early this year, the company signed a dealership agreement with Cray Research Inc. to market Cray's entry-level Y-MP2E supercomputer.

In the coming months, the company expects its $100 million investment in Steve Jobs's Next Inc. finally to pay off. Canon expects sales of NeXTcube workstations, which it has marketed exclusively in Japan since 1989, to increase 10-fold. That projected jump is due to the fact that users who once had only English-language software now will have workstations that sport a Japanese network operating environment. Nevertheless, Tom Murtha, an analyst for Baring Securities Inc. in Tokyo, remains skeptical. "It will still be uphill, even with Japanese language support, because Next is seen as being an unproven player."

For the long term, Canon's strong suit will continue to be digital-imaging technology. Late last year, the company introduced a plain paper facsimile machine ready to accommodate Nippon Telegraph and Telephone Co.'s Integrated Services Digital Network (ISDN) service. According to Murtha, Canon is also the leading contender to develop and commercialize a cost-effective color desktop printer in the early 1990s.

Canon's total revenues rose a healthy 28% to ¥1.73 trillion ($11.9 billion) in 1990. IS revenues rose 25%, to ¥585 billion ($4.0 billion). Net earnings rose over 60% to ¥61.4 billion ($424.1 million) in 1990.

Canon expects its total sales revenues for 1991 to increase approximately 10%, a figure which Baring Securities believes to be slightly optimistic, considering the speed and depth of the anticipated recovery in export markets.—*Marsha W. Johnston*

NTT Data Communications Systems Corp.

17 Mori Building
26-5 Toranomon, 1-chome
Minato-ku, Tokyo 105, Japan
(81-3)-3509-4647

RANK
7
IS REVENUE
$2.38 B

Systems integration and facilities management giant NTT Data Communications Systems Corp., has not been immune to the ailments of the Japanese financial markets.

For many years, banks and financial services firms have been the largest information technology investors in Japan. But the financial market is feeling the effects of higher interest rates and tighter profit margins; thus, demand for new IT investments is weakening.

This has inevitably hurt NTT Data. The company's customers include all of Japan's leading banks and financial institutions; indeed, NTT Data earns 50% of its income from the financial market. Sales in fiscal year 1990, ending March 31, 1991, increased 12.7% to a record high of ¥345 billion ($2.4 billion). But net earnings declined by 13% to ¥12.7 billion ($87.7 million). Results were negatively affected by high depreciation, high interest rates and, according to the company, heavy use of subcontractors.

NTT Data, a wholly owned subsidiary of Nippon Telegraph and Telephone Corp. (NTT), has designed and delivered on-line fund transfers for 4,800 banks and financial institutions and their 44,000 offices throughout Japan. The company also developed and installed Japan's largest on-line system for nationwide postal banking services. The system links more than 24,000 post offices nationwide.

In 1990, NTT Data took its first cautious steps toward establishing international status. Initially, it intends to support Japanese financial sector customers doing business abroad. Last year, it established offices in London and New York City, but revenue from these operations have so far been modest. One big win: the New York office signed a contract to design a network for Wall Street's Dai-ichi Kangyo Bank.

Despite the current difficult business climate, NTT Data forecasts that its sales will increase faster this year than last, by 16% to about ¥400 billion. The company says growth will be fueled by markets for systems integration and facilities management, which are expected to continue growing 10 to 15% annually.—*Weje Sandén*

Ricoh Co. Ltd.

15-5, Manami-Aoyama 1-chome
Minato-ku, Tokyo, Japan
(81-3)-479-3111

RANK
8
IS REVENUE
$2.33 B

Ricoh Co. Ltd.'s strategy of integrating data and image processing continued to pay off in 1990. Strong peripheral and PC sales helped Ricoh's IS revenue rise 31% to ¥337.6 billion ($2.33 billion) as of the fiscal year ending March 1991. But, despite healthy revenue, earnings fell 14.6% to ¥13.6 billion ($93.6 million). The company attributes the drop to the intense competition in the facsimile machine market, which squeezed profit margins; the rise in the yen's value in 1990; sizable research and development investments; and the cost of setting up new manufacturing facilities overseas.

Successful products introduced last year include the Refile 21R rewritable optical filing system, a bundled hardware and software product designed to replace conventional office filing systems. Ricoh's Image 420 series of digital copiers, including a full-color model, was also well received. The company plans to introduce a new generation of low-end laser printers this fall.

Digital technology is crucial to the company's strategy of linking data and image processing. "The key word at Ricoh is *multimedia*," says Kunihito Minakawa, manager of Ricoh's finance department. Ricoh remains weak in the systems integration field, however, and analysts say the company will have to emphasize SI to complement its acknowledged expertise in multimedia.

Ricoh, which has been selling IBM PCs on an original equipment manufacturer (OEM) basis since 1987, strengthened its ties with IBM in April 1990, when it formed a 50-50 joint venture called RIOS. The venture, based in Kanagawa prefecture near Tokyo, is developing interfaces between Ricoh office automation and image-processing products and IBM computers. It is also conducting research into joint hardware development. In April 1991, the company struck an agreement to supply IBM with Ricoh's 32-bit PS5223-S notebook computer, which IBM will sell on an OEM basis. IBM already sells a 16-bit notebook from Ricoh.—*Steve McClure*

Nihon Unisys Ltd.

17-51, Akasaka 2-chome
Minato-Ku
Tokyo 107 Japan
(81-3)-3585-4111

RANK
9
IS REVENUE
$2.24 B

Nihon Unisys Ltd. stayed tough this last year. Its largest shareholder, Unisys Corp., tried to sell its 34% stake in Nihon Unisys, and the mainframe computer business in Japan grew at its slowest pace ever. Still, Nihon Unisys managed to hold onto its share of the Japanese mainframe, PC and software markets. Maintaining market share and growth had its price, however, as the company's dismal earnings were far lower than expected.

Despite revenue growing a reasonable 13.5% to ¥324.6 billion ($2.24 billion), net earnings dropped a whopping 57% to just ¥2 billion ($13.9 million). Heavy competition and razor thin margins on hardware in the Japanese market accounted for much of the earnings loss. Nihon Unisys reacted to the lower margins by cutting its work force by 8%, a move that most likely kept the company out of the red.

Yamaichi Securities is one company that is confident in Nihon Unisys's staying power. The firm was among the first to purchase the computer maker's newest and most powerful mainframe, the Unisys 2200/900. This machine, imported from Unisys in the United States, can be linked up to three other 2200/900s, each with a maximum of eight processors. An equally powerful mainframe, the A19, was also announced this year and will be delivered at the end of 1991.

Nihon Unisys continues to resell on an original equipment manufacturer (OEM) basis most of its hardware from Unisys and other manufacturers and is really beginning to feel the financial pinch of this strategy. The PCs and laptops that Nihon Unisys continues to OEM from Toshiba Corp., for example, help fill out the company's product line but don't add much to the bottom line. To counter this trend, Nihon Unisys has focused much of its efforts on value-added services and software. This year, software made up 24% of all revenue.

To strengthen its position in the important software niche that Nihon Unisys has carved out for itself in Japan, the company embarked on a major joint venture with auto giant Toyota Motor Corp. The two companies have formed a separate software company called Toyota Soft Engineering; Toyota owns 65%, and Nihon Unisys owns 35%. The move is expected to strengthen Nihon Unisys's expertise in computer-aided design and manufacturing (CAD/CAM) software, a rapidly growing niche in the Japanese software market.—*Tom Wood*

OKI ELECTRIC INDUSTRY CO. LTD.

7-12 TORANOMON 1-CHOME
MINATO-KU, TOKYO 105, JAPAN
(81-3)-3501-3111

RANK
10
IS REVENUE
$2.09 B

Sales of high-speed automatic teller machines and other data-processing equipment to banks account for 40% of Oki Electric Industry Co. Ltd.'s business—a statistic that didn't help Oki much last year. When Japanese banks began to feel the economic pinch in 1990 due to factors such as the declining Japanese real estate market and lower customer savings rate, Oki's growth slowed.

Total corporate sales rose just 5% to ¥660.9 billion ($4.56 billion), while profits slid 39% to ¥9.9 billion ($68.1 million). DATAMATION estimates Oki's IS revenue at over ¥300 billion ($2.09 billion).

Oki's focus on the financial world hasn't prevented it from expanding its IS activities in other areas. The company recently introduced its Oki Station 7300 workstation. Designed primarily for engineering applications, the 32-bit machine is Oki's first major attempt to offer a UNIX-based computer. "We're expecting a lot from this product," says Touru Mori, general manager of the general planning office in Oki's information systems group.

The company is also designing local area networks for clients in the financial services industry, as the idea of downsizing catches on among Japanese companies. Also to that end, Oki launched the AX Note 386A, a 32-bit laptop, in August 1990, aiming it at the business market.

One problem Oki faces is developing software for its computers. Like other Japanese companies, Oki uses a network of subcontractors to design software, but Mori says it's difficult for the subcontractors to keep up with demand.

Sales of printers in the year ending March 1991 were good. Oki, long known for its dot matrix printers, is now setting its sights on the laser printer market. The company established a printer factory in Britain in 1988, and in August 1991 the Japanese company was to have completed a deal to buy Technitron PLC, a British printer sales company. That deal was intended to solidify Oki's position in the European market ahead of the European Community market integration, set to occur at the end of 1992.—*Steve McClure*

MITSUBISHI ELECTRIC CORP.

2-3 MARUNOUCHI, 2-CHOME
CHIYODA-KU, TOKYO 100
(81-3)-218-2111

RANK
11
IS REVENUE
$1.83 B

This spring, Mitsubishi Electric Corp. moved into the second phase in the expansion of its information and communications system division, which it established four years ago. Now the division will provide business solutions that run on standards-based systems in open architectures. Mitsubishi plans to strengthen its research and development efforts in this area and is forming partnerships with other suppliers to bring business applications and open systems to market.

Although Mitsubishi says that sales for the division have increased by 14% every year, the group has failed to gain significant market share. The group's other spring announcements seem to indicate that Mitsubishi has recognized the division's weaknesses in developing hardware and software and has decided to become essentially a value-added remarketer of other vendors' equipment.

The most striking evidence of this is an original equipment manufacturer (OEM) deal Mitsubishi has struck with IBM. Big Blue will supply Mitsubishi with the key technologies of its low-end System 390 mainframes; Mitsubishi will sell those models under its own name in Japan. The Tokyo firm says it expects to sell 900 units over the next three years, at prices ranging from ¥127 million to ¥686 million ($877,000 to $4.7 million). Mitsubishi used to make mainframes, but has a market share in Japan of less than 5%.

The IBM deal and others with Hewlett-Packard Co. and the U.K.'s Apricot Computers Ltd. are sure to help Mitsubishi gain political brownie points for lessening trade tensions by tying up with foreign companies. Mitsubishi has purchased more than 10,000 of HP's HP-UX-based workstations for resale in Japan. It has also licensed the HP-UX source code and HP's Precision Architecture-RISC technology. Mitsubishi is also reselling Apricot's i486-based ST Server, its Qi workstations and its local area network terminal.

Worldwide sales for fiscal 1990, ending in March, were up 11% to ¥3.32 trillion ($22.9 billion). Net earnings were up 4% to ¥79.8 billion ($550.8 million). Information and communications systems revenue totaled ¥265 billion ($1.83 billion), up 16% from last year's figures.—*Marsha W. Johnston*

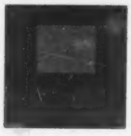
C. ITOH TECHNO-SCIENCE CO.

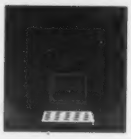
16-7, KOMAZAWA 1-CHOME
SETAGAYA-KU, TOKYO 154, JAPAN
(81-3)-3419-9000

RANK
12
IS REVENUE
$1.60 B

Trading company C. Itoh & Co. spun off its office and factory automation divisions in October 1989 to form subsidiary C. Itoh Techno-Science Co. (CTC), a computer reseller. Since then, CTC has begun to carve out a niche for itself as a systems integrator.

Factory automation now plays a decreasing role in CTC's activities, with office automation (OA) the company's primary growth area. In the past, securities companies and banks were the firm's principal OA systems integration customers. But





recently CTC has expanded its customer base to include firms in other industries, including distribution and transportation, for example.

The company designs systems incorporating Sun Microsystems computers, which it sells under the Sun brand name. Spokesman Kanehiko Ishii says that Sun workstations, such as the 32-bit SPARC WS, were a major growth area for the firm last year. He adds that the company, which markets its wares solely in the Asia/Pacific region, is now expanding the range of computers it sells and services. In May, for example, CTC started to market Intel Corp.'s IPSC-860 supercomputer.

"Ninety percent of our sales consist of computers from overseas because we can't compete in selling computers from Japanese manufacturers," says Ishii. "And we concentrate on UNIX-based systems because it's quite advanced and accepted by customers in Japan, since it's convenient to switch to UNIX systems from NEC-based ones."

Given the increasing competition in the hardware field, the firm ultimately hopes to switch its emphasis to software development. Presently, CTC develops some software in house but for the most part relies on suppliers in the United States. —*Steve McClure*

SEIKO EPSON CORP.

3-5 OWA 3-CHOME
SUWA-SHI, NAGANO-KEN 392, JAPAN
(81-26)-652-3131

RANK 13
IS REVENUE $1.59 B

Continuing its battle with NEC Corp. and Toshiba Corp. for supremacy in the notebook and laptop computer sector, Seiko Epson Corp. introduced four new models of its Note PC and a new color laptop in 1990.

The new notebooks include two 80286-based units—PC-286 Note F and PC-286C—and two 386SX models—PC-386 Note A and PC-386 Book L. In a nod to the commercial failure of its first Note computer, the Note F and Note A are equipped with both integrated circuit card slots and floppy drives. The first Note, which operated exclusively on IC cards when it was introduced in the summer of 1989, lost out in the market to Toshiba's heavier, but standard disk drive-equipped, Dynabook.

The color laptop that Seiko Epson alluded to in last year's DATAMATION 100 did indeed arrive at midyear, as promised. The 32-bit PC-386LSC's metal insulator metal diode color liquid crystal screen, which Seiko Epson developed, can display 16 colors simultaneously from a palette of 4,096 colors. The company says the display has a resolution comparable to traditional CRTs.

Seiko Epson is a private company and does not release its financial results. DATAMATION estimates its IS revenues increased almost 10% to $1.59 billion. Sixty percent of IS revenues came from peripherals, and the rest came from personal computers, the company says.—*Marsha W. Johnston*

ACER INC.

602 MIN SHENG EAST ROAD
TAIPEI 10445, TAIWAN
(886-2)-718-2349

RANK 14
IS REVENUE $751.0 M

Last year, Acer Inc. conceded that its subsidiary Counterpoint, a U.S. multiuser computer systems maker, had failed to live up to its intended role—providing Acer with a UNIX platform and support for the company's U.S. marketing and service operation. As a result, Acer acquired another U.S. computer firm with a UNIX heritage—Altos Computer Systems. All this prompted a major restructuring last September, including the merger of Counterpoint into Acer America Corp.

The move helped pump up Acer's revenues to $949 million, in line with its historical 30 to 40% growth levels. But profits sank 59% to $2.4 million, due in part to costs associated with the acquisition.

However, president Leonard Liu dismisses the poor earnings by saying that Acer is not trying to turn a quick profit. "Stan Shih [chairman and chief executive officer] and his management team want to build a microcomputer company that is going to be around," he says.

Still, acquisitions aside, some of Acer's financial woes can be traced to shortcomings at Acer itself. New product development slowed in 1990. And, although the company says it has been working on long-term projects, outsiders observe that Acer's senior management has been overly immersed in joint venture activities and management problems outside Taiwan.

Liu cites Acer's strategic strengths in a number of areas as key to the company's future. These strengths include a full line of PC products, the production of memory chips through a joint venture with Texas Instruments Inc. and in-house design and production of application-specific chips through an alliance with National Semiconductor Corp. A line of color monitors and Acer's production of its own Basic Input/Output System (BIOS) chips round out the company's strengths.

Alarmed by the paucity of its new product introductions last year, Acer has been introducing a flood of items in 1991, including a 386SX notebook computer and the first 486SX with the CPU on a single chip. But the biggest lessons that Acer's management has learned are that sales don't automatically grow, and big problems take time to solve.

—*Lewis H. Young*

NOMURA RESEARCH INSTITUTE LTD.

134 GOHDO-CHO
HODOGAYA, YOKOHAMA 240, JAPAN
(81-45)-333-8100

RANK 15
IS REVENUE $652.3 M

The Nomura Research Institute Ltd. (NRI) is another company whose rapid growth over the past few years has been fueled by the increasing importance of systems integration in Japan. NRI is part of the group of companies controlled by stockbroker giant Nomura Securities. Forty percent of NRI's business is consulting and SI work done for its parent company.

NRI's sales increased 27% to ¥139.5 billion ($963.5 million) in the fiscal year ending March 1991, but net earnings dropped almost 18% to ¥7.5 billion ($51.6 million). IS revenue rose only a marginal 1% to ¥94.5 billion ($652.3 million) due to debt burdens, construction of NRI's new headquarters in Yokohama and a new office in Osaka.

Within the last year, NRI has opened offices in Frankfurt, Paris and Zurich, bringing to nine the number of bases the firm has overseas. NRI's customers outside Japan are either Nomura Group companies or other Japanese firms requiring SI expertise.

Inside Japan, NRI's customers—apart from Nomura group firms—have been companies in the distribution field, such as 7-Eleven Japan, for which NRI helped set up an on-line inventory-accounting system featuring Tandem Computers Inc.'s fault-tolerant hardware. "Recently, we've also been aiming at manufacturers and government offices," says Tokoyuki Hotta of NRI's planning department.

In finance, the core of NRI's business, the company is placing more emphasis on workstations featuring software that helps clients design new types of financial instruments and run simulations. Analysts point out that NRI is well qualified to offer this service, since parent Nomura Securities makes wide use of workstations in its operations.

—*Steve McClure*

TATUNG CO.

22 CHUNGSHAN NORTH ROAD, 3RD SEC.,
TAIPEI, TAIWAN, 10451
(886-2)-592-5252

RANK 16
IS REVENUE $593.4 M

Taiwanese conglomerate Tatung Co., which makes everything from electric fans to power generators, shipped its first PC in 1981. Since then, the company's IS business has grown rapidly, mainly by supplying computer monitors to original equipment manufacturer (OEM) customers like IBM.

The appreciation of the New Taiwan dollar in the recent years, along with heavy international competition, has drastically squeezed the profit margin of Taiwan's electronics industry. As a result, Tatung, which exports more than 70% of its products, realized flat corporate revenues of NT$50 billion ($1.88 billion) in 1990. Worldwide PC price wars contributed to Tatung's flat sales.

In addition to making monitors, PCs and laptop computers, Tatung has been trying to revive the company's growth by introducing high-end workstations. At last year's Siggraph show, Tatung rolled out its Mariner 4i SPARC-based workstation; later, at COMDEX/Fall 1990, it introduced another SPARC workstation, the TWS-5020.

Tatung expects to ship 10,000 SPARC workstations in 1991, ranging in price from $7,000 to $11,000. Distribution plans will focus on export sales primarily to North America and Europe, although it plans to appoint distributors in Japan, as well.

—*Hugo X. Hsiung*

CSK CORP.

SHINJUKU SUMITOMO BUILDING
6-1 NISHI-SHINJUKU 2-CHOME
SHINJUKU-KU, TOKYO 163, JAPAN
(81-3)-334-1811

RANK 17
IS REVENUE $527.2 M

CSK Corp., a subsidiary of conglomerate CSK Group, is one of Japan's largest independent computer services firms. It made its international breakthrough in 1990 when it acquired Micrognosis Inc., of Danbury, Conn., from Control Data Corp. Micrognosis, which supplies integrated trading room systems to the international financial services community, has 425 employees and operates in 15 nations in North America and Europe. In addition, CSK acquired an equity stake in Wavefront Technologies Inc., a California-based company that develops and markets three-dimensional graphics and animation software.

As of January 1, 1991, CSK established a new subsidiary, CSK International Corp., which is assigned to expand CSK Corp.'s overseas operations. The subsidiary will also provide support to Micrognosis.

Last year, in order to expand CSK's market presence in Japan, the company started to establish regional computer services franchises. In 1990, the company started seven franchises; it intends to have 50 by the end of the decade. The franchises will develop software, provide maintenance and sell computers and supplies.

CSI Corp. Ltd., a joint venture with IBM Japan Inc. founded in September 1989, assumed CSK's small and medium-sized computer sales business; CSI's sales are not consolidated into CSK Corp.'s revenues.

In fiscal year 1990 (ending September 20), CSK Corp.'s total sales grew 11.8% to ¥80.2 billion ($553.9 million); net earnings increased 12% to ¥4.8 billion ($32.8 million). Revenue from computer software climbed a substantial 22% to ¥62.3 billion ($430.5 million), but hardware sales were down almost 16% to ¥14 billion ($96.7 million).

—*Weje Sandén*

SONY CORP.

7-35, KITASHINAGAWA 6-CHOME
SHINAGAWA-KU, TOKYO 141 JAPAN
(81-3)-3448-2111

RANK 18
IS REVENUE $499.5 M

To many people, Sony Corp. is synonymous with Walkmans, but a growing number of IS users have become familiar with the company's workstations, PCs, graphics terminals and storage devices. Sony's computer products often demonstrate the same penchant for innovation that has characterized Sony's consumer electronics offerings.

Still, only a very small portion of Sony's overall revenues, which totaled ¥3.6 trillion ($25 billion) in fiscal year 1990 (ending March 31, 1991), up 25.6% from the previous year, come from information systems products. Televisions, video and audio equipment accounted for 65% of Sony's 1990 revenues; music and filmed entertainment made up 20%. Industry observers and DATAMATION estimate that Sony derives about 2% (¥72.3 billion or $499.5 million) of its total revenue from IS products.

Corporate operating income remained flat at ¥297 billion ($2.05 billion) in FY90, but net earnings rose 13.7% to ¥117 million ($808 million).

One of Sony's most successful IS thrusts has been in the optical storage marketplace. By the end of 1990, Sony held 64% of the worldwide installed base of 5¼-inch rewritable optical media and drives, says Kathryn Hilton, an analyst at Infocorp., a Santa Clara market research firm.

Sony joined with Hewlett-Packard Co. to develop digital data storage (DDS) technology. By December of this year, Sony plans to begin volume shipments of a 3 ½-inch, 4-millimeter DDS tape drive that will store up to 4 gigabytes of data.

The IS product that has gained Sony the most attention recently is its Networked Engineering Workstation (NEWS) 3250, a 17.7-pound portable UNIX workstation based on the R3000 reduced instruction set computing (RISC) processor from Mips Computer Systems Inc.—*Dwight B. Davis*

KYOCERA CORP.

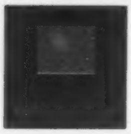
5-22 KITAINOUE-CHO HIGASHINO
YAMASHINA-KU, KYOTO 607, JAPAN
(81-75)-592-3851

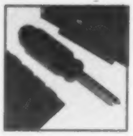
RANK 19
IS REVENUE $480.0 M

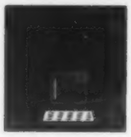
Kyocera Corp. felt the effects of poor laser printer sales last year, especially in Europe. Laser printers account for 55% of Kyocera's IS sales, and consequently revenues increased only 4% in fiscal 1990, to ¥69.5 billion ($480 million), while corporate reveunues increased almost 10% to $3.2 billion. The Kyoto-based company's net corporate earnings fell 5% to ¥32.3 billion ($222.7 million).

Along with ailing printer sales, Kyocera blames the depressed European economy and intense competition from manufacturers such as printer giant Hewlett-Packard Co. for the less than spectacular results. The rise in the value of the yen in the second half of the year also had a negative effect on Kyocera, which exports 41% of its products. Additionally, the company paid ¥5 billion ($34.5 million) in settlement of an environmental lawsuit against AVX Corp., a U.S. electronics parts maker, which Kyocera acquired in 1989. AVX lost that lawsuit before the acquisition.

Kyocera is one of the world's largest manufacturers of integrated circuit (IC) packages, and the IC realm is the company's primary business. However, last year the firm increased its IS profile. It introduced a 32-bit Intel Corp. processor-based PC called the Multilight, which is designed for office use. The Multilight is the first PC that Kyocera has manufactured; previously, it resold PCs on an original equipment manufacturer







(OEM) basis. So far, sales in Europe, one of the company's most important IS markets, have been poor. Kyocera also began manufacturing 16-bit laptops on an OEM basis last year for another firm, whose name Kyocera declines to reveal.

This March, Kyocera introduced a lightweight (1.3 pound) pocket computer in Japan called the Refalo. The company has high hopes for the product, but it's still too early to tell whether that optimism is well placed. Kyocera plans to make Refalo available in Europe and North America during this fiscal year.

The firm also sold $6 billion worth of hard disk drives last year, but profits were low because of tough competition, which led to price cutting. A bright spot for Kyocera was liquid crystal display (LCD) manufacturing. The company sold $5 billion worth of LCDs in 1990 and expects sales to increase 20% this year.

Kyocera typically increases research and development spending by 20 to 25% a year, and 1990 was no exception. R&D rose 21% to ¥22.7 billion ($156.5 million). Most of that went toward research into ceramic materials, as well as to R&D of telecommunications and office automation equipment.—*Steve McClure*

MITAC INTERNATIONAL CORP.

585 MING SHENG EAST ROAD
TAIPEI, TAIWAN
(886-2)-501-8231

RANK 20
IS REVENUE $450.0 M

Mitac International Corp., fared well in 1990 because the company focused on making money, not just sales when the worldwide computer economy turned soft.

"We tried to keep the profit target, not the sales target," chairman Matthew Miau says. Those sales, which the company reports in dollars, grew 18% to $450 million—way off its original target of 32% or $505 million. But the company did manage to preserve profits, which, at $23.2 million remained level with 1990's performance.

In late 1990, Miau reorganized the company, establishing five regional headquarters for strategic business units and revamping its accounting systems. Among his motives was a desire to address the company's new businesses—notably PC monitors, motherboards and portable computers. Last year, the company generated 51% of its revenues from personal computers and another 33% from peripherals.

The multiple headquarters concept reflects the different strategies Mitac has developed for each part of the world. Last year, the firm generated 19% of its revenues in North America, 43% in Europe, 30% in Asia and 8% in other regions. In the United States, the company sells mainly to original equipment manufacturers (OEMs), instead of trying to build a brand name identity. In Europe, Mitac sells machines bearing its name. In third-world countries, where price is paramount, Mitac sells motherboards and licenses its technology to other manufacturers.

New products and new businesses are expected to put Mitac back on the fast growth path in 1991. This projection is fueled partially by the $NT475 million ($17.8 million) the company spent on research and development in 1990. Mitac's new products include the 428OG Extended Industry Standard Architecture (EISA) 486 system and a new line of high-performance, small footprint Apache workstations. The company also has started production of the first Taiwanese PC monitor that meets the Scandinavian countries' low radiation standards, said to be the toughest in the world.

All this activity should lead Mitac toward 40% growth in 1991.—*Lewis H. Young*

INTEC INC.

2-11 OKUDAMACHI, TOYAMA
TOYAMA PREFECTURE 930, JAPAN
(81-764)-32-5511

RANK 21
IS REVENUE $402.7 M

Intec Inc.'s expertise in software development and value-added networks (VANs) helped the company achieve a solid 18% rise in corporate revenue to ¥58.3 billion ($402.7 million) in the fiscal year ending March 1991. Corporate profits rose 10% to ¥2.4 billion ($16.5 million). Over the next three years, Intec hopes to double its total annual sales to reach ¥100 billion.

The company's goal is to balance all four of its major business areas—data processing, software development, information systems and data communications operations—so that each sector accounts for 25% of its business. The company will have to push data communications hard in order to achieve this goal, as now it lags behind other operations with only 13% of the business. At present, software development outweighs the others, pulling in almost 39% of Intec's revenue. Data processing accounts for 20% and information systems almost 28%.

"In the past few years, the company has put a lot of energy into the VAN field," says a company spokesperson, who also points out that in 1982 Intec became the first Japanese company to offer VAN services. Starting this October, Intec will offer Integrated Service Digital Network (ISDN) services, becoming only the second Japanese firm after Nippon Telegraph and Telephone Corp. (NTT) to do so.

Intec made two major agreements with overseas firms this past fiscal year. In December, the firm signed a technical cooperation contract with Canada's Northern Telecom Ltd. The agreement involves an exchange of Intec's networking know-how for Northern Telecom's technical expertise in switching technology.

In February, Sprint International bought the licensing rights to Intec's facsimile service switching software, in order to start a value-added fax service this summer. Intec has marketed Sprint's communications systems in Japan since 1982.

In August 1990, the company completed work on a new ¥8 billion ($55 million) regional headquarters in Yokohama, just outside Tokyo. The facility gives Intec a much more visible location from which to operate, since Toyama, its headquarters, is far from the center of Japan.—*Steve McClure*

GOLDSTAR CO. LTD.

20, YOIDO-DONG
YOUNGDUNGPO-GU,
SEOUL 150-721, KOREA
(82-2)-787-1114

RANK 22
IS REVENUE $391.0 M

In 1990, Goldstar Co. Ltd. reaped rewards from painful lessons it learned in 1989. That year, Goldstar Co. Ltd.'s star fell, as the $4 billion subsidiary of $25 billion Lucky Goldstar Group faced rising interest rates, won and wages. The maker of home appliances, audio and video equipment, televisions and information systems products, Goldstar Co. felt the pinch—1989 profits remained flat against sales that fell 7.8%. Labor strikes caused an estimated $600 million loss in production.

But Goldstar's 1989 trouble might have been the best thing that could have happened to it. To combat its problems, the company, family-run since the Koos founded Lucky Goldstar in 1947, implemented a tough strategy that called for change on several fronts.

First, the ruling family loosened the reins and allowed professional managers to make more decisions. (It did so in part by appointing a new president and chief executive officer, Hun-Jo Lee, in 1990.) That strategy, in turn, helped Goldstar drastically improve product quality, so that the company could use quality rather than price to compete in the

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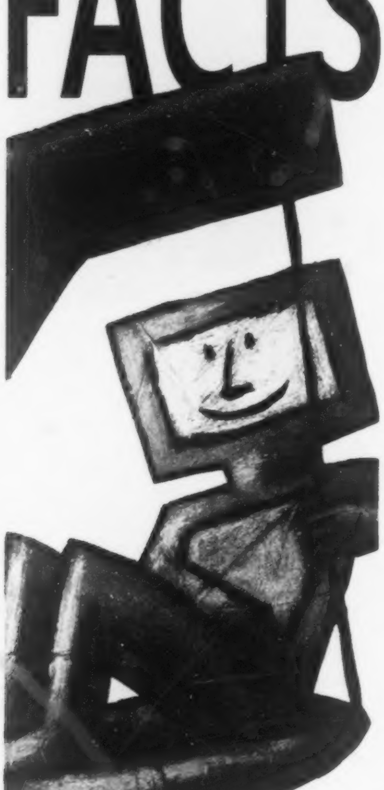

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global market. This was critical since, due to the rising won, Korean-manufactured goods cost as much as Japanese products, but aren't considered to be as technically advanced.

In fiscal 1990 (ending December 31, 1990), Goldstar successfully carried out much of the plan it conceived in 1989. With the help of healthy sales to Germany and Eastern Europe, revenue climbed 14.6% to W2.98 trillion ($4.22 billion). Profits shot up: earnings hit a celestial 86.6% growth rate, soaring to W33.7 billion. ($47.5 million).

DATAMATION estimates that less than 10% ($391 million) of Goldstar's business is in IS, including PCs, workstations, midrange systems, monitors and printers. Last year, it introduced a 12.5-million-instruction-per-second workstation based on the Scalable Processor Architecture (SPARC). It also brought out an 80486-based server and a 386SX laptop. In the works are an 80MIPS SPARC clone and color laser printers.

In May 1991, Lucky-Goldstar completed a notable $15 million purchase of a 5% stake in Zenith Electronics Corp., the $1.4 billion Glenview, Ill., television manufacturer. The deal allows Goldstar to use Zenith's flat-screen television technology, called Flat Tension Mask, in its TVs and monitors. In turn, Goldstar provides its considerable global marketing and distribution resources to loss-making Zenith. *—Elaine L. Appleton*

ALPS ELECTRIC CO. LTD.

1-7, YUKIGAYA-OTSUKA-CHO,
OTA-KU, TOKYO 145, JAPAN
(81-3)-726-1211

RANK
23
IS REVENUE
$384.1 M

What a difference a year makes. In fiscal 1989, Alps Electric Co. Ltd.'s net profit was a paltry ¥711 million ($5.15 million) due to the severe effect the then-rising dollar and subsequent higher domestic operating costs had on the company's overseas subsidiaries. But in its last fiscal year, which ended in March 1991, the firm's profits skyrocketed more than 11-fold to ¥8.2 billion ($57 million) on the strength of solid sales of electronic components used in telecommunications, car-audio and satellite broadcast systems. Total revenue at ¥462 billion, ($3.26 billion) was up 14.7% over 1989's level.

Alps's IS revenue was less profitable than the other divisions in FY90, as price competition among peripherals makers remained strong. The company, one of the world's largest independent suppliers of floppy disk drives, is aware of the need to boost its sales of both printers and disk drives. Sales of both types of products together rose only 1% to ¥55.6 billion ($384.1 million) in FY90.

"Alps is a latecomer when it comes to value-added products like hard- and floppy-disk drives," says Junichi Saeki, research manager of Dataquest Japan's information systems group. "But I think they have the confidence to survive in a tough market, and they have a strong potential for growth, as end-users become more aware of their name."

Alps's overseas operations produce 30% of the company's revenues. Revenue from its Singapore subsidiary surged 33% ahead of last year's, largely due to strong sales of IS-related products in European markets. The firm's Taiwanese operation, however, recorded a profit decline due to stiff competition from Taiwanese IT suppliers.

Alps expects its IS earnings picture to improve in the next 12 months as it cuts costs, particularly in its overseas operations. It projects further growth in the satellite-broadcast related field, as well as in liquid crystal displays (LCDs), an area in which it is placing great hopes. *—Steve McClure*

OMRON CORP.

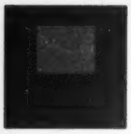
KARASUMA NANAJO,
SHIMOGYO-KU,
KYOTO 600 JAPAN
(81-75)-344-7000

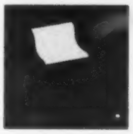
RANK
24
IS REVENUE
$291.3 M

The highlight of Omron Corp.'s 1990 fiscal year, which ended March 31, 1991, was its March 12 acquisition of Nippon Data General (a subsidiary of Westborough, Mass.-based Data General Corp.) for ¥6.5 billion ($44.9 million). The acquisition boosted Omron's corporate assets by 23% but won't add revenue to the bottom line until next year. In fiscal 1990, total corporate revenue jumped 11.6% to ¥464.4 billion ($3.21 billion), but earnings grew only 3.2% to ¥21.5 billion ($148.3 million), the same slow but steady growth rate as the previous year.

The ambitious Data General deal capped off a fiscal year that began with the announcement of a three-year intensive investment plan. According to Omron senior general manager Akio Imaizumi, the plan is designed to promote growth in many areas, including adding new North American sales offices and extending Omron's North American network of office automation dealers and distributors.

Omron's sales of office automation systems, including workstations, peripherals and photocopier components, increased





15% during fiscal year 1990. A full 95% of its office automation business comes from sales outside Japan. Of Omron's four other major product groups—control components and systems, electronic funds transfer (EFT) systems, traffic control systems and health care and medical equipment—the largest share of revenue (61%) comes from its control components and systems group.

In May 1990, Omron added a reduced instruction set computing (RISC) UNIX workstation, the LUNA 88K, to its LUNA workstation line. The product was well received in the United States and was recently adopted as the development support system by Carnegie Mellon University in Pittsburgh. Omron is working with CMU to develop Japanese and Chinese versions of the Mach operating system, which is used in the Open Software Foundation's OSF/1 operating system.

Omron says that its peripherals equipment, including a newly introduced pocket-sized modem, scanners and uninterruptible power supplies, has been selling well despite stiff competition from other Asian companies.—*Laura K. Johnson*

DAEWOO TELECOM LTD.

541 NAMDAEMOON-RO 5, CHONG-KU
C.P.O BOX 6080
SEOUL, KOREA
(82-2)-726-2052

RANK 25
IS REVENUE $200.2 M

Using the copycat strategy for which the Japanese have become famous, Daewoo Telecom Ltd. has learned well how to compete in world markets. However, since 39% of its business is in North America, the company felt last year's economic pinch as much its Asian peers have.

Daewoo's total corporate revenue rose only .3% to W211 billion ($298.1 million) in 1990. IS revenues grew a healthy 8.9% to W141.71 billion ($200.2 million). However, Daewoo invested heavily, adding 21% to its W284.15 billion ($405.9 million) asset base, causing a whopping drop of 49% in net earnings, which came in at a mere W3.40 billion ($4.8 million). A 2.8% drop in employment helped curb earnings losses in 1990.

Daewoo's strategy is heavily weighted toward selling desktop computers; PCs and workstations made up more than 63% of the company's business in 1990. The company become one of the initial supporters of the Advanced Computing Environment (ACE), giving Daewoo Telecom a fair start in the production of next-generation, reduced instruction set computing (RISC)-based desktop workstations.

Leading Edge Products Inc., Daewoo Telecom's Westborough, Mass.-based PC subsidiary (which the company purchased in November 1989), still has yet to become profitable. However, Leading Edge's customer base and distribution channels will be a much-needed help when Daewoo announces its first ACE machines later this year.

Appian Engineering Inc., Daewoo Telecom's San Jose subsidiary, has given the company a small position in the semiconductor market, and Appian's previously declining fortunes have finally begun to rise. Appian has extended its product lines to include microprocessors used in video cards. Expect to see more of Daewoo Telecom's Appian microprocessors in computers, fax machines and telecommunications equipment in 1991.

—*Tom Wood*

THE ASIAN 25

For more information on the DATAMATION Asian 25 companies, circle numbers on Reader Card, above or below.

Fujitsu	570	Seiko Epson	582
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Oki	579	Goldstar	591
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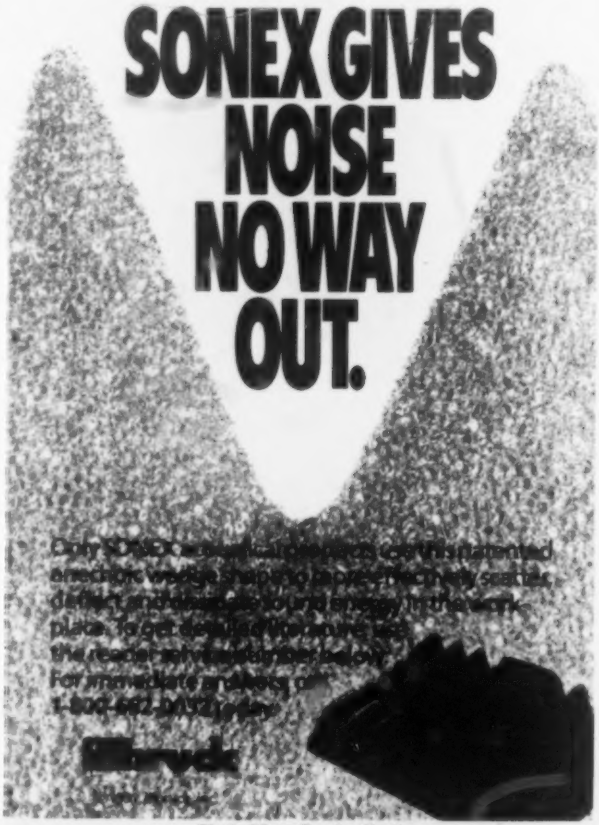
C. Itoh	581	Omron	593
		Daewoo	594



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NEW PRODUCTS

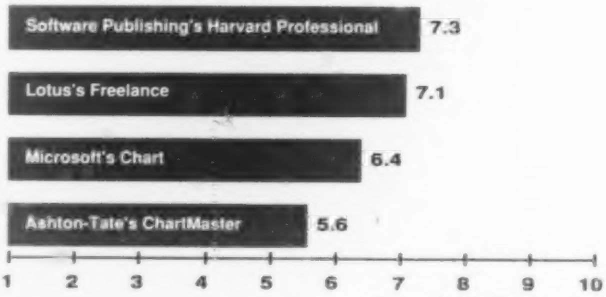
A SELECTION OF RECENT INTRODUCTIONS

DATAMATION'S
PRODUCT
REVIEW

Corporate Satisfaction Scorecard: Graphics

DATAMATION surveyed IS managers who have purchased PC graphics software to determine their level of satisfaction. Owners of Harvard Professional Graphics and Lotus Freelance reported almost equal satisfaction with their purchases. ChartMaster and Microsoft Chart owners, however, are less pleased.

(1=Not satisfied, 10=Most satisfied)



Source: DATAMATION, December 1990

▶ SOFTWARE

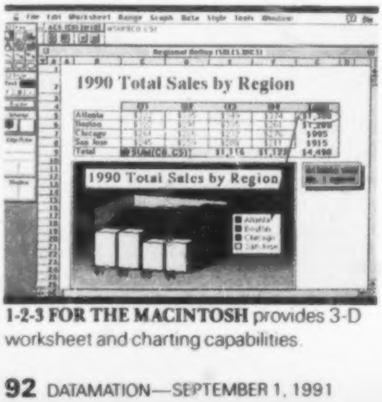
1-2-3 On The Mac

Lotus Development Corp.'s 1-2-3 spreadsheet has jumped to yet another platform: Apple Computer Inc.'s Macintosh. 1-2-3 For The Macintosh provides 3-D worksheet and graphics capabilities; compatibility with Microsoft Corp.'s Excel spreadsheet and other versions of 1-2-3; external data access; and support for Apple's System 7.0. operating system.

Lotus designed 1-2-3 For The Mac as a unified work environment, so all data, graphs and macros reside in the same file. Data and graphs are dynamically linked so any changes made to the worksheet are automatically reflected in graphs. 1-2-3 For The Mac provides formatting, keystroke and macro compatibility with all versions of 1-2-3, and it reads Excel 2.2 and 3.0 worksheet files. The Mac version uses the Classic Menus found in the Windows version of 1-2-3.

The $495 software runs on any Mac from the Mac Plus on up. It requires a hard disk and 2 megabytes of memory when running under System 6.0; 3MB when running under System 7.0. LOTUS DEVELOPMENT CORP., Cambridge, Mass.

Circle 535



1-2-3 FOR THE MACINTOSH provides 3-D worksheet and charting capabilities.

Managing Windows

Symantec Corp. designed The Norton Desktop For Windows for people who find Windows's interface less than intuitive. The new file management and utilities package lets users copy, move, view, launch, delete and print files simply by dragging and dropping icons. For example, to print a file, users just click on a file and drag it to the print icon.

The software also provides automated backup, data recovery and network support, and it includes a collection of Windows-specific tools. The Norton Disk Doctor For Windows repairs mutilated files, unformats disks and retrieves erased files. The SuperFind utility helps users search for text on any drive, including network drives.

The $149 program requires at least a 286-level machine with Windows 3.0, DOS 3.1 or later and 1 megabyte of memory; 2MB is recommended. SYMANTEC CORP., Cupertino, Calif.

Circle 536

Password Security

Password Coach software prevents users from selecting passwords that are easy to guess. The package checks selected passwords against a 140,000-word dictionary; if it finds the word, it forces the user to make a different choice.

The system prevents users from choosing common first and last names, biographical names, geographical places, medical or legal words, technical and scientific terms, acronyms, reversed words, variations of account names and pop culture names, such as Batman. Security managers can expand and customize the dictionary to include organization-specific words.

Password Coach runs on the DEC VAX, the IBM AS/400 and Novell NetWare systems, and can work with any operating system or software that uses passwords, says the vendor. The package sells for $1,400 per server. BASELINE SOFTWARE, Sausalito, Calif.

Circle 537

▶ PCs & WORKSTATIONS

PS/2s For Multimedia

IBM has expanded its line of PS/2 computers with four models, including one model that's suitable for multimedia applications. The models are the 35 SX and LS, 40 SX and 57 SX.

MARKET INSIGHTS

A SURVEY OF TECHNOLOGY TRENDS

You Don't Need ISDN To Link Voice, Data

BY WARREN CHILDS
Business Research Group

Implementation of Integrated Services Digital Network (ISDN) technology continues to rise at a snail's pace—fewer than 10% of DATAMATION's Technology Panel members say they use ISDN today. But a strong interest is building in ISDN among potential users of computer-assisted telephony (CAT). The customer premises-based equivalent to ISDN, CAT can be used to implement integrated voice and data applications on site without requiring ISDN capability.

Of those users who plan to implement CAT voice data applications, some 63% say they also plan to implement ISDN; only 14% say they won't consider doing so. Compare that with the existing base of CAT users. Only 30% of them have already implemented ISDN.

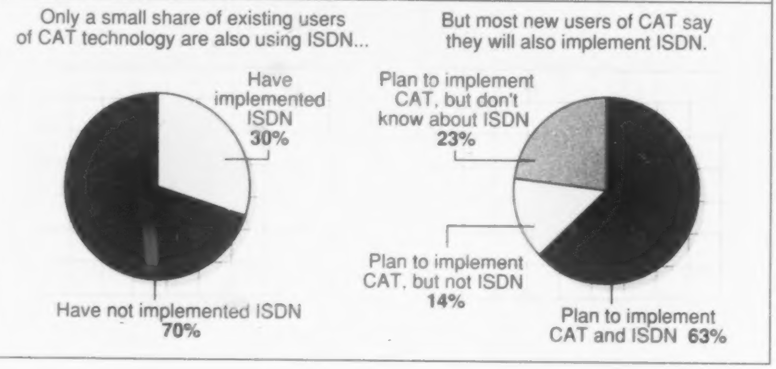
A number of vendors offer products that can link voice and phone number data for incoming calls via a user's private branch exchange (PBX) to computer systems, thereby generating integrated voice and data applications. These products can work in conjunction with ISDN, but they don't require ISDN capability in order to facilitate voice-data applications.

Such integrated CAT voice and data applications are primarily being used to improve operator efficiency in large companies' customer service departments. CAT's ability to simultaneously deliver voice calls and data files to an operator's workstation can reduce the time required for an operator to set up each call, connect with customers and access the data needed to complete the call.

Some 87% of CAT users say they've realized reductions in cost and gains in efficiency that meet their expected payback for implementing the technology; 98% say they are satisfied with their use of CAT.

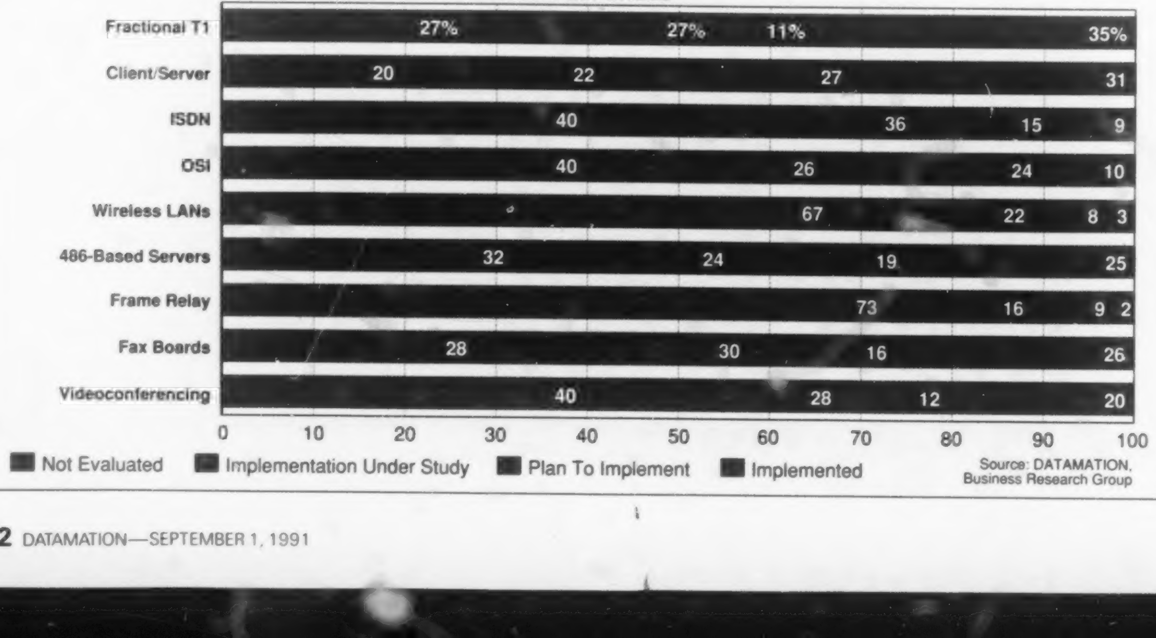
For more information, call Nancy Finn at (617)-964-6204, fax her at (617)-558-4402 or write to her at the Business Research Group, 275 Washington Street, Newton, MA 02158.

ISDN Plays Second Fiddle To The CAT



DATAMATION's Technology Implementation Index: Networks/Communications

DATAMATION each month surveys a select group of its readers--the DATAMATION Technology Panel--to investigate the implementation of new technologies by key user organizations.



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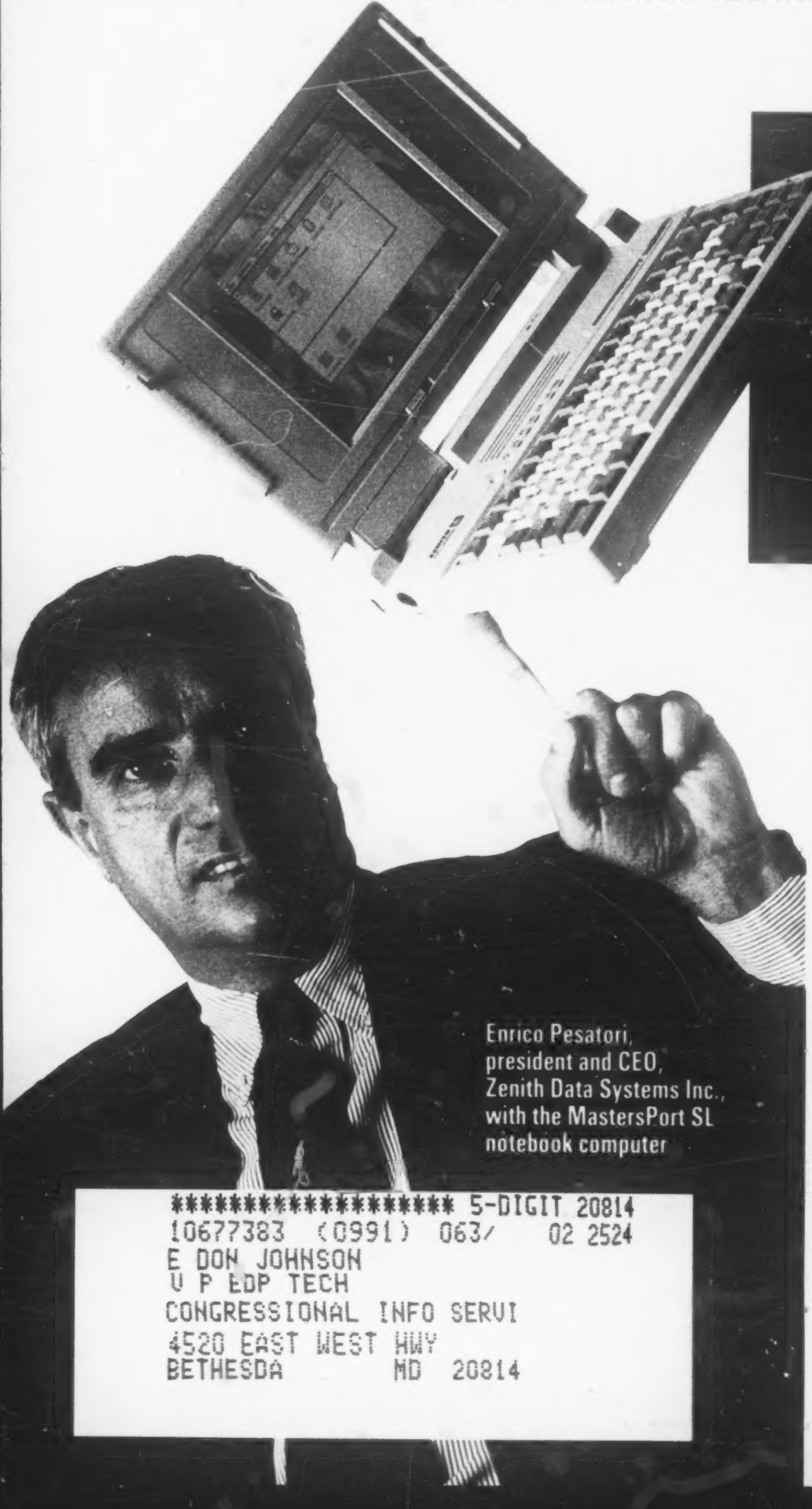
SEPTEMBER 15, 1991



Enrico Pesatori, president and CEO, Zenith Data Systems Inc., with the MastersPort SL notebook computer

Zenith's Comeback Portable

page 28

Diagnostic Software Speeds PC Checkups *page 40*

OCR Comes Down To The Desktop *page 44*

The New Modems: Fast And Cheap *page 51*

On The Fast Track To HR Integration *page 61*

Optical Drives' New Reading Habits *page 71*

Where To Turn For Client/Server Skills *page 79*

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Micro-To-Host Links

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DATAMATION

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VOLUME 37
NUMBER 18

Zenith's MastersPort SL steps into the ring with Intel's 386SL microprocessor.

COVER STORY

NOTEBOOK PCs

Zenith's Comeback Portable 28

BY NED SNELL After letting its portable computer business slip into a two-year rest mode, Zenith Data Systems has hit the Resume button, delivering a new 386SL notebook and a message: "We're back."

Cover photography by Andy Goodwin

SPECIAL REPORT

ROUNDTABLE

What PC Managers Say About OS/2 34

EDITED BY
PAUL PINELLA

From DOS 5.0 and Windows 3.0 to OS/2 2.0, what will emerge as tomorrow's preferred platform is being debated today in MIS shops around the world.

PRODUCT GUIDE

FEATURE

Getting Work Groups To Work 81

BY SARAH H. LINDSEY

If you're tired of spending your time tracking down coworkers and sorting through mountains of memos, Coordination Technology wants to help you get organized.

Coordination Technology's Scott Gellis, Yvonne Dahl and Bill McSweeney team up to sweep the clutter off your desk.

FEATURES

PCs & WORKSTATIONS

MAINTENANCE

Diagnostic Software Speeds PC Checkups 40

BY PAUL PINELLA These new diagnostic software tools can quickly determine what ails your sickly PC—sometimes before you even remove the cover.

IMAGING

OCR Comes Down To The Desktop 44

BY BOB FRANCIS Optical character recognition software used to be too pricey for wallet-conscious PC users—not to mention that PC OCR didn't work very well. Now, prices have plummeted and quality has risen.

NETWORKS

MODEMS

The New Modems: Fast And Cheap 51

BY TOM McCUSKER Dial-up modems sporting speeds of 14,400bps are already hitting the market, with prices headed for the $500 neighborhood.

E-MAIL

Seven Steps To Successful E-Mail 56

BY RONALD G. CHILDS Standard transports, gateways and addresses help smooth out the wrinkles in an enterprise mail system. Now all you have to do is get users to take advantage of all that integrated communications capability.

SOFTWARE

APPLICATIONS

On The Fast Track To HR Integration 61

BY LEILA DAVIS It's high time your human resource management systems started talking to your payroll and benefits applications. New integrated, distributed HR applications are making it a whole lot easier to do.

CASE

Unisys CASE Gets Graphic 69

BY MIKE RICCIUTI Designer Workbench, a graphical user interface development tool for Unisys's CASE products, gives mainframe applications graphical pizzazz on PCs.

SYSTEMS

OPTICAL STORAGE

Optical Drives' New Reading Habits 71

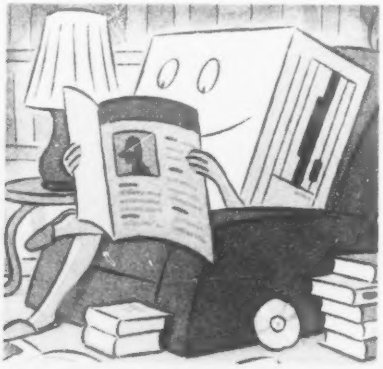
BY DWIGHT B. DAVIS Multifunction optical drives combine rewritable and write-once capabilities, eliminating the need for two drives. But the products have brought a tangle of optical technologies.

CLIENT/SERVER

Where To Turn For Client/Server Skills 79

BY JEFF MOAD Programmers schooled on mainframes may balk when asked to learn to use client/server development tools. And retraining can cost a fortune. Here's a way out of the retraining nightmare.

Newmont Mining's Costine struck gold with an integrated HR application, page 61.



Multifunction drives support a variety of media, page 71.

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LETTERS

A Microsoft Partner Speaks

The July 1, 1991 issue of DATAMATION featured Microsoft SQL Server and its use in client/server architecture ["Microsoft's Client/Server Challenger," p. 28]. Your feature article included a sidebar with a "sampling" of sixteen front-end tools. We contend that our application development tool, Object/1, was noticeably absent from that "sampling" even though we fulfill a significant role as a Microsoft SQL Business Partner.

Currently, there are only seven Microsoft SQL Business Partners in this select program administered by Mr. Dwayne Walker, vice-president of the Microsoft Server Applications Group. As a Microsoft SQL Business Partner, Mdbs is authorized to bundle our front-end development tools (Object/1, KnowledgeMan and GURU) with Microsoft SQL Server and further provides technical expertise in the development of these graphical applications.

Gary W. Rush
President
Mdbs
Lafayette, Ind.

Atanasoff, 4; Eckert-Mauchly, 1

The Letters Department of the May 15, 1991 issue of DATAMATION [p. 10] contains four letters that all argue that you should have honored Atanasoff as the real inventor of the electronic computer.

I hope you have room for one more letter on that subject. I congratulate you on your very appropriate recognition of the UNIVAC I anniversary, and your recognition of J. Presper Eckert and John Mauchly as the inventors of the ENIAC and the UNIVAC. Their collaboration at the Moore School of the University of Pennsylvania in 1942–1946 produced the first general-purpose, programmed electronic computers and initiated the modern age of computers. The company that they formed in 1946 that became the Eckert-Mauchly Computer Corp. was the beginning of the commercial computer industry.

There have been several books and papers published in the past few years that argue that Atanasoff must be recognized as the inventor of the electronic computer because of his failed attempt to build an electronic linear equation solver at Iowa State College in Ames, Iowa, in the years 1939–1942. Lawyers for Honeywell in a dispute over patents discovered that John Mauchly had visited Atanasoff in June of 1941 and had seen his partially completed computer and an unpublished document that described how it worked. Atanasoff left Iowa State in 1942 and was almost unknown in the computer field until he surfaced as a witness for Honeywell many years later.

Readers who are interested in the publications mentioned in the preceding paragraph may enjoy reading a review article entitled "The Origins of Modern Computing," which I published in the September 1990 issue of *Computing Reviews* (Vol. 31 No. 9 p. 449–481). The editors of *Computing Reviews* included responses from several people who disagree (and some who agree) with the opinions expressed in the article.

Saul Rosen
Professor of Computer Science
Purdue University
West Lafayette, Ind.

The Importance Of Being Open

Edward Spire's letter ("A Faster Switch To UNIX," June 1, p.12) was right on the mark. The tools for UNIX exist today! What one encounters more often are users who listen to too many techies who feel the world will end if their favorite proprietary OS or hardware architecture is abandoned. They have not learned to take a wider corporate/institutional view of issues. It's an obvious human trait. They will perhaps be required to learn something quite new. So what! Such is life, change, growth and hopefully progress. This is also one of the best arguments for UNIX and open architectures. Even with the "flavors" of UNIX (and they are decreasing in number every day), moving to another UNIX platform or finding new UNIX-trained employees is becoming increasingly easier than doing the same in a proprietary world.

Those techie gurus (the keepers of the technical holy grail in an organization), who refuse to consider other issues than strictly some esoteric benchmark, then use their influence and mystical jargon to instill a sense of insecurity in the user community. They get increasingly desperate if the old, "It's technically inferior," doesn't work. They then move to, "You'll need to get all new software and relearn everything." When that doesn't hold water (i.e., the user comes to realize that either his/her favorite software has already been ported to a much better interface or that he/she can use DCL commands on a Sun if such is REALLY desired—just like those who will use Windows or OS/2 for the next decade by opening a DOS window and doing all their work there!), the real desperation sets in. We then hear, "We can't support you."

When the support/technical staff hit the organization with that, they should be told to grow up or move on. At that point, these individuals are only covering their own self-interest to the detriment of the whole organization. Their lack of willingness for professional growth shows the same stagnation that is now coming to haunt American industry. Fortunately, managers and users no longer kowtow to these "keepers of the holy byte" and the vendors that supply and encourage them.

John Neubert
Director, Academic Computing
Drew University
Madison, N.J.

CORRECTION

In the June 15, 1991 DATAMATION 100 issue, the table Big Exporters In North America (page 18) inadvertently omitted Unisys Corp. as the fourth largest exporter, with revenues of $2.88 billion in Europe, $1.3 billion in Asia and $558 million in other regions.

ACCESS

There are several ways to use DATAMATION beyond just reading it. You can call on our experts—the editors who specialize in certain fields are eager to hear of your experiences in and thoughts on how to manage information technology resources. You can contribute articles to the magazine by supplying us with manuscripts for our review. You can learn how competitors and colleagues are using software and systems from our research department, which can provide details of both published and unpublished studies on various aspects of technology use. And you can always voice your opinion by submitting a letter to the editor.

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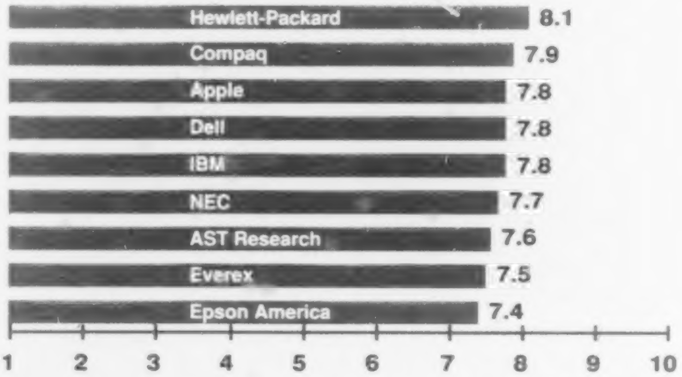
NEW PRODUCTS

A SELECTION OF RECENT INTRODUCTIONS

Corporate Satisfaction Scorecard: 386-Based PCs

DATAMATION surveyed [illegible] managers who have purchased 386-based PCs to determine their level of satisfaction.

(1=Not satisfied, 10=Most Satisfied)



Source: DATAMATION, June 1991

▶ SOFTWARE

1-2-3 On The Factory Floor

Do you know what's happening on your factory floor? Lotus Development Corp. has released a 1-2-3 add-on designed to make sure you do. @Factory Bundle provides automatic and real-time communications between Lotus's 1-2-3 spreadsheet and plant floor devices. It funnels data into the spreadsheet for monitoring, analysis and reporting.

@Factory Bundle communicates with programmable logic controllers, process controllers, other computers, operator terminals, robots, bar code readers, instruments and similar shop-floor devices. Lotus says MIS departments can also use @Factory for logging data, activity-based costing, material requirements planning (MRP) reporting and sharing data.

@FACTORY BUNDLE provides the communications link necessary to give managers a look at plant floor activities

@Factory requires at least an XT-level PC, a hard disk and 512 kilobytes of memory. Prices range from $2,500 to $3,000, depending on the communications drivers included. LOTUS DEVELOPMENT CORP., Cambridge, Mass.

Circle 560

The Spreadsheet's Resolve

Claris Corp. says it built Resolve from the ground up to work with Apple Computer Inc.'s System 7.0 operating system. The new Macintosh spreadsheet supports all System 7.0 features, including Publish & Subscribe, Apple Events, balloon help, TrueType and virtual memory. Users can employ Publish & Subscribe to create dynamic links to documents, and they can use Apple Events to link spreadsheets to other applications to create custom apps.

The package provides one-step charting: click on the Make Chart option, and Resolve automatically creates a chart. The package includes 25 different chart types, including polar, wireframe, contour, surface and true 3-D charts. Resolve's scripting language lets users create scripts and attach them to HyperCard-like buttons. Scripts can access Pascal or C external procedures. The $399 package imports and exports Excel 2.2, Informix Wingz 1.0 and 1.1, Lotus 1-2-3 WKS, WK1, SYLK and text file formats. Resolve retails for $399. CLARIS CORP., Santa Clara.

Circle 561

Cooperative Knowledge Processing

Cooperative Processing For KBMS (knowledge-based management systems) lets application developers distribute knowledge-based applications across IBM mainframes, DEC VAXs and PCs. PC or VAX/VMS users can transparently access KBMS applications on IBM mainframes or another VAX using the target application's data, definitions, rules or other application components. For example, a KBMS application on a workstation can perform natural-language processing while the host application updates information in corporate databases.

The PC-to-IBM mainframe version runs under OS/2 or DOS on the PC and uses a coaxial, Synchronous Data Link Control (SDLC) or local area network gateway connection to the mainframe. The OS/2 version supports both the Logical Unit Type 2 (LU2) and LU6.2 communications protocols; the DOS version supports only LU2. PC-to-VAX communications use DECnet task-to-task communications. For VAX-to-IBM connections, the product uses the DECnet/SNA APPC/LU6.2 Programming Interface with VMS/SNA or a DECnet/SNA gateway communications interface.

A software license for IBM mainframes is $35,000. Prices range from $10,000 to $35,000 for VAX systems. AICORP., Waltham, Mass.

Circle 562

MARKET INSIGHTS

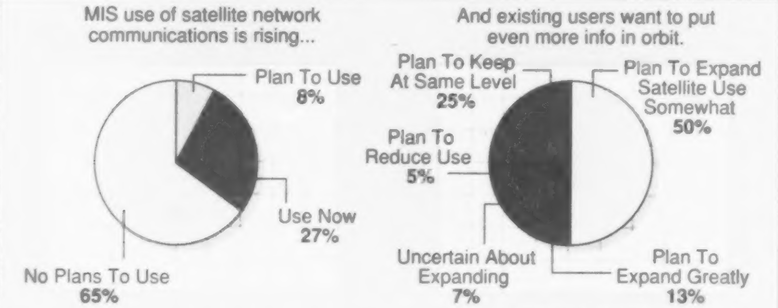
A SURVEY OF TECHNOLOGY TRENDS

Networks Head For Outer Space

BY WARREN CHILDS
Business Research Group

Considering their exotic nature and their need for strong technical staff support, satellite communications networks are being implemented at a healthy clip. In the most recent survey of DATAMATION's Technology Panel, 27% of panel members are currently using satellite communications to some extent, and an additional 8% are planning to do so. Sixty-three percent of those who now use satellite communications expect their use will continue to grow.

In Orbit With The MIS Space Patrol



Source: Business Research Group

Falling prices and improved technology are making satellite communications an attractive alternative to terrestrial networks. Currently, some 40,000 VSAT terminals are in the field, and the Business Research Group estimates that their use will grow at a rate somewhere between 20 to 45% annually over the next few years.

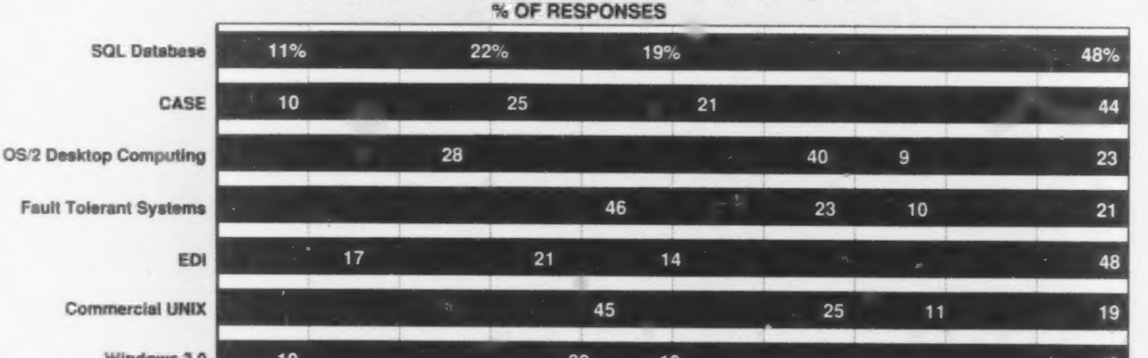
A satellite network consists of earth stations (such as VSATs) that communicate with each other via a satellite orbiting above the earth. Space-based networks have a number of features that make them attractive for special applications. Because the communications signals are broadcast over the airwaves, the transmission cost is the same regardless of the distance or the number of locations receiving the signal. Any location where a dish antennae can be set up can have access to a satellite network.

Of course, use of satellite communication has a few drawbacks. It is affected by poor weather conditions and, because any station can pick up a signal, managers must consider important security problems. Add to that the fact that, like cable, satellites have a limited life span, so some questions exist as to whether the National Aeronautics and Space Administration (NASA) will continue to support new satellite launches. ▭

For more information, call Nancy Finn at (617)-964-6204, send her a fax at (617)-558-4402 or write to her at the Business Research Group, 275 Washington Street, Newton, MA 02158.

DATAMATION's Technology Implementation Index: Systems And Software

DATAMATION each month surveys a select group of its readers--the DATAMATION Technology Panel--to investigate the implementation of new technologies by key user organizations.



Source: Business Research Group

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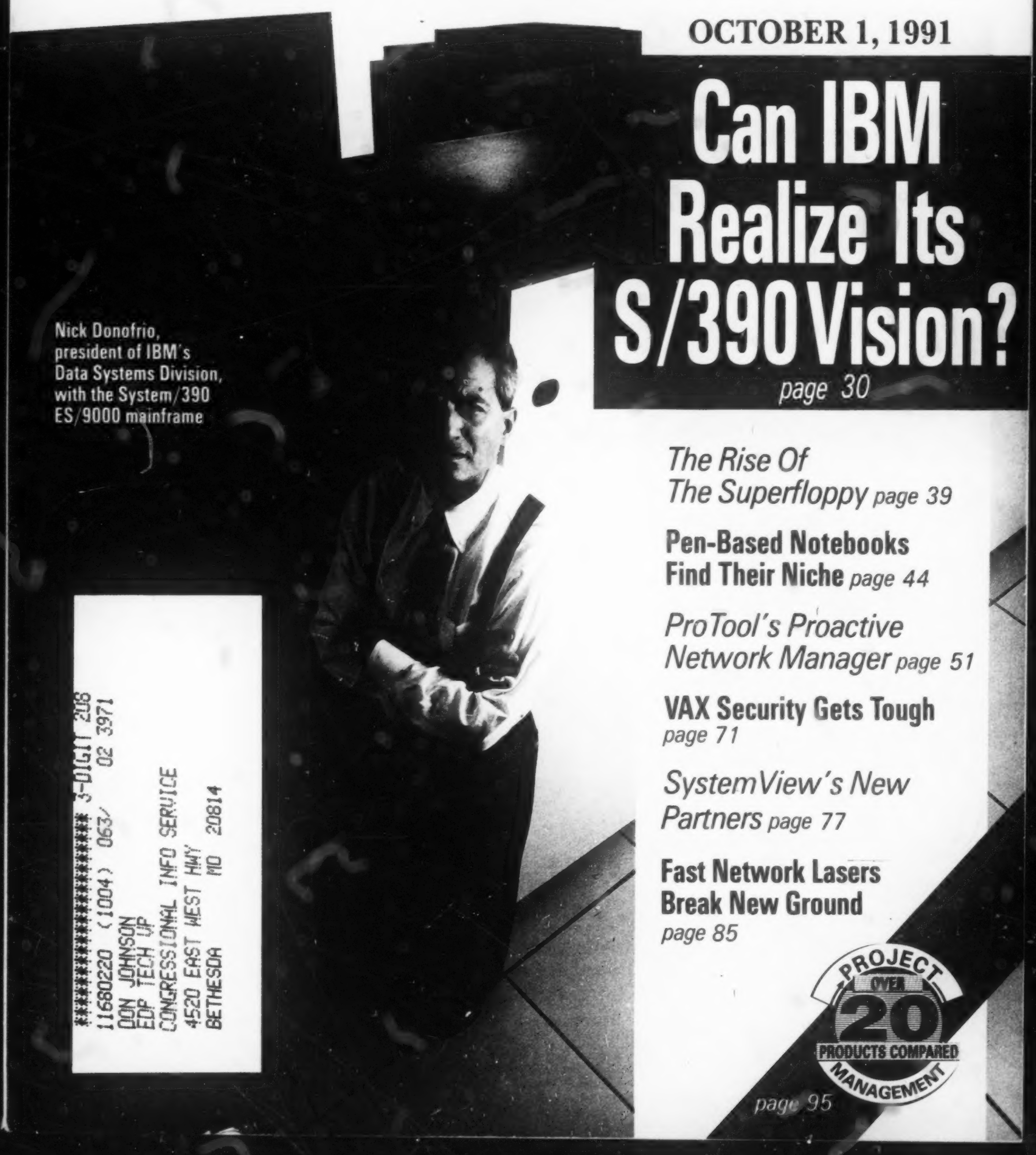

Nick Donofrio, president of IBM's Data Systems Division, with the System/390 ES/9000 mainframe

Can IBM Realize Its S/390 Vision?

page 30

The Rise Of The Superfloppy *page 39*

Pen-Based Notebooks Find Their Niche *page 44*

ProTool's Proactive Network Manager *page 51*

VAX Security Gets Tough *page 71*

SystemView's New Partners *page 77*

Fast Network Lasers Break New Ground *page 85*

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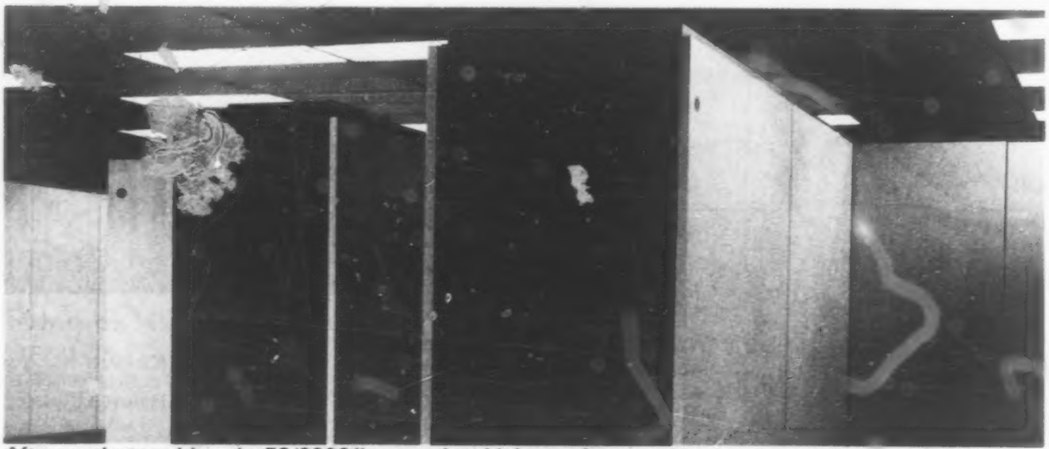
NUMBER 19



After a rocky transition, the ES/9000 line promises higher performance, lower prices and better reliability.

COVER STORY

MAINFRAMES

Can IBM Realize Its S/390 Vision? 30

BY JEFF MOAD IBM's top of the line ES/9000 model 820 and 900 mainframes are finally shipping. But their ability to play an expanded role as highly parallel managers of enterprise data, applications and systems has yet to be proven.

Cover photography by Alan Orling/BlackStar

SPECIAL REPORT

TOP 50 SOFTWARE COMPANIES

Software's Big 50 58

BY DENNIS HAMILTON AND J. WILLIAM SEMICH

Stunned by the success of Microsoft's Windows 3.0 technology, independent software vendors are working hard to evolve their products to meet users' revolutionary new demands for interoperability, ease of use and standards.

PRODUCT GUIDE

FEATURE

From Text To Icons 91

BY ELIZABETH LINDHOLM

If you're thinking about cooperative processing, Must Software International says its Flashpoint For Nomad can help developers take the first step.

Must's Murphy: Smoothing out your mainframe applications' front ends can make life easier for users.

FEATURES

PCs & WORKSTATIONS

STORAGE

The Rise Of The Superfloppy 39

BY RICK COOK The once-humble 3½-inch floppy is back, bigger and better than ever. IBM's 2.8MB drive looks like a winner, but the more intriguing 20MB models from smaller players could run into a standards roadblock.

PORTABLES

Pen-Based Notebooks Find Their Niche 44

BY BOB FRANCIS Today's pen-based computers are not likely to convince many office workers to abandon their keyboards. But for millions of field workers, the technology is well suited to specialized applications.

Suppliers of pen-based notebooks will first target mobile workers.

NETWORKS

LANs

ProTool's Proactive Network Manager 51

BY TOM McCUSKER Protolyzer's data-filtering and simulation capabilities let LAN administrators head off trouble before it shows up on the network.

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SECURITY

VAX Security Gets Tough 71

BY MIKE RICCIUTI After suffering two black eyes, Digital Equipment Corp. is serious about its operating system security. But is it too late for VAX/VMS and ULTRIX users?

SYSTEMS MANAGEMENT

SystemView's New Partners 77

BY LEILA DAVIS Since last year, eight of IBM's original SystemView product partners have dropped by the wayside. IBM says it's working hard to bring them back soon.

SYSTEMS

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Fast Network Lasers Break New Ground 79

BY NED SNELL New network laser printers are fast and flexible—and that redefines the options for distributed-printing strategies.

MAINFRAMES

Swifter 2200 Eases Unisys Users' Fears 85

BY ELAINE L. APPLETON In the face of losses and layoffs, Unisys has introduced a new high-end mainframe. And users, who credit Unisys with world-class technology, are welcoming news of the 2200/900, the most powerful 2200 system to date.

INTERNATIONAL

Special supplement, not available in all issues 80-1

DECUS's Kahle bemoans that DEC systems are frequent targets for hackers, page 71.

DATAMATION'S

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SPECIAL REPORT

SOFTWARE'S BIG 50

1990

Stunned by the success of Microsoft's Windows 3.0 technology, independent software vendors are working hard to evolve their products to meet users' revolutionary new demands for interoperability, ease of use and standards.

BY DENNIS HAMILTON AND J. WILLIAM SEMICH

The $13 billion-plus in revenue realized last year by the biggest 50 North American independent software companies—along with the tens of billions more in software revenue taken in by major systems companies—testifies to the continued strength of demand for products from the software industry. Despite the recession, IS managers scraped up an extra $3.2 billion to spend on new technologies offered by those top 50 software vendors last year, an increase of 32%.

And no wonder—the new technology is superb, and when it is good, it is very, very good. So why be surprised that it is in great demand?

Take top vendor Microsoft Corp.'s revolutionary new Windows 3.0 technology. After introducing it in April of last year, Microsoft claims to have already shipped some 5 million copies of the easy to use graphical environment. Sales of Windows and Windows-based applications have helped Microsoft leapfrog past behemoth Computer Associates International Inc. to first place in our list of the top 50 independent software vendors this year. Sales at the company grew by an astounding 55% last year. Not bad for an old-line PC software company that's been in the computer business since the 1970s.

The phenomenal reach of Windows technologies into all markets—in the home, among professional power users and in large and small corporate shops—now has users clamoring for more of the same from the rest of the information technology industry. Explains Harriet Schabes, a vice president in the Technology Office of New York City-based Citicorp: "We are joining forces with lots of other end users to demand from our suppliers—both the

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DATAMATION's Big 50 Software Companies

RANK 1990	RANK 1989		REVENUE 1990	REVENUE 1989	% CHANGE	1990 R&D	R&D AS % OF REV.	NET INCOME	1990 EMPLOYEES	CIRCLE NO.
1	2	Microsoft Corp.	1,477.8	951.8	55.26%	204.5	13.8%	355.6	6,700	405
2	1	Computer Associates International Inc.	1,310.7	1,291.0	1.53%	172.5	13.2%	162.0	7,000	406
3	3	Oracle Corp.	1,027.8	729.3	40.93%	132.9	12.9%	36.4	6,811	407
4	4	Lotus Development Corp.	684.5	556.0	23.11%	102.7	15.0%	23.3	3,538	408
5	5	D&B Software Services Inc.	538.7	450.0	19.71%	N/A	N/A	N/A	3,800	409
6	6	Novell Inc. ¶	497.5	421.9	17.92%	59.3	11.9%	94.3	2,419	410
7	9	WordPerfect Corp.*	452.4	281.4	60.77%	49.4	10.9%	N/A	2,376	411
8	_	Mentor Graphics Corp.	435.2	426.4	2.06%	74.5	17.1%	23.6	2,747	412
9	7	Software AG*	389.0	294.0	32.31%	97.3	25.0%	N/A	3,800	413
10	_	Policy Management Systems Corp.	346.1	265.6	30.31%	58.2	16.8%	37.2	4,204	414
11	8	McDonnell Douglas Systems Integration Co.	271.0	290.0	-6.55%	32.0	11.8%	6.0	2,000	415
12	13	American Management Systems Inc.	262.0	225.3	16.29%	12.0	4.6%	12.0	2,900	416
13	15	Ask Computer Systems Inc.	249.7	189.6	31.70%	22.2	8.9%	4.7	2,084	417
14	14	SAS Institute Inc.*	240.2	205.6	16.83%	100.9	42.0%	N/A	2,230	418
15	_	CompuServe Inc.•	238.9	203.1	17.63%	N/A	N/A	N/A	1,500	419
16	17	Autodesk Inc. §	237.9	178.6	33.20%	24.4	10.3%	56.8	905	420
17	12	Pansophic Systems Inc.	232.2	199.3	16.51%	16.9	7.3%	19.6	1,583	421
18	_	Cadence Design Systems Inc.	231.4	159.9	44.72%	42.6	18.4%	38.0	1,663	422
19	11	Ashton-Tate Corp.	230.5	265.3	-13.12%	39.7	17.2%	-18.1	1,620	423
20	18	Cincom Systems Inc.*	207.7	165.1	25.80%	N/A	N/A	N/A	1,358	424
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26	26	Adobe Systems Inc. ^	168.7	121.4	38.99%	N/A	N/A	40.1	500	430
27	22	Information Resources Inc.	166.7	136.4	22.21%	N/A	N/A	2.8	2,982	431
28	27	Software Publishing Corp.	153.5	110.4	39.04%	25.3	16.5%	20.6	723	432
29	24	Candle Corp.*	151.4	128.1	18.19%	45.2	29.9%	N/A	1,000	433
30	20	Informix Software Inc.	146.0	145.0	0.69%	15.0	10.3%	-46.4	1,350	434
31	25	Compuware Corp.*	143.0	123.0	16.26%	N/A	N/A	N/A	1,244	435
32	_	Aldus Corp.	134.9	98.0	37.76%	N/A	N/A	N/A	N/A	436
33	30	System Software Associates Inc. •	121.0	94.9	27.50%	7.6	6.3%	17.1	N/A	437
34	29	Cognos Inc.	120.0	98.6	21.70%	13.7	11.4%	6.0	1,041	438
35	37	The Santa Cruz Operation Inc.*	119.0	83.0	43.37%	17.0	14.3%	N/A	1,326	439
36	33	Goal Systems International Inc.	116.9	86.4	35.30%	14.6	12.5%	10.3	800	440
37	38	BMC Software Inc.	116.6	76.3	52.82%	17.4	14.9%	22.6	548	441
38	31	Comshare Inc.	116.0	94.6	22.62%	16.5	14.2%	6.4	980	442
39	40	Systems Center Inc.	105.0	78.0	34.62%	23.0	21.9%	-28.0	841	443
40	41	Symantec Corp.	102.0	71.0	43.66%	14.0	13.7%	7.0	520	444
41	39	Boole & Babbage Inc.	100.2	78.9	27.00%	15.6	15.6%	4.8	654	445
42	34	American Software Inc.	99.1	88.4	12.10%	3.6	3.6%	17.2	812	446
43	36	On-Line Software International Inc.	96.7	86.0	12.44%	7.7	8.0%	4.0	659	447
44	46	KnowledgeWare Inc.	92.3	50.1	84.23%	10.5	11.4%	11.7	555	448
45	42	Softlab Inc. *	86.7	70.5	22.98%	18.0	20.8%	N/A	750	449
46	32	Interleaf Inc.	84.0	92.0	-8.70%	17.0	20.2%	-2.0	756	450
47	43	Micro Focus Inc.	84.0	58.1	44.58%	11.8	14.0%	15.7	330	451
48	_	J.D. Edwards & Co.	79.4	42.5	86.82%	5.7	7.2%	4.6	682	452
49	44	Attachmate Corp.*	78.0	56.4	38.30%	N/A	N/A	N/A	N/A	453
50	_	Sage Software Inc.	70.0	62.0	12.90%	13.9	19.9%	1.8	470	454
		TOTAL	13,385.9	10,807.0	23.86%					

NOTES:
Revenue, R&D and net income are in $ millions.
• DATAMATION estimate

* Privately held
§ Based on fiscal year ending Jan. 31, 1991
¶ Based on fiscal year ending Oct. 27, 1990

^ Based on fiscal year ending Nov. 30, 1990
For more information, circle appropriate number on Reader Card

platform vendors and the software vendors—the direction that we want to go in."

That direction generally reflects a group of technologies for which relatively few products actually exist today—in particular, easy to use interfaces, interoperable applications and hardware, and consistent standards across all systems. Windows, which meets the demand for an easy to use interface, is an exception. Sybase Inc.'s SQL Server and DB2 Gateway technologies are others. IBM's new, more powerful OS/2 2.0 Presentation Manager is an untested but possible contender for that honor this year.

But Windows has taken some eight years to develop to its present state, OS/2 has been in development for four years and neither is a finished product even now. Sybase has been struggling for years to prove its client/server products in the field while also continuing to evolve them to meet fast-changing user demands.

"Let's face it," say Carole Morton, president of Sterling Software Inc.'s Dylakor Division, "everyone has gone client/server happy. Local area networks. How we get everybody to talk to everybody. All this heterogeneous data. Everybody wants SQL. How is all this going to happen?"

Software vendors are working hard to make it happen by continuing to boost spending on research and development aimed at redirecting technologies. Examples include SAS Institute Inc., where R&D spending chews up some 42% of revenue. SAS is in the midst of a major effort to develop its new SAS Application System 6.07, which will include a Windows 3.0 interface, interoperability with other vendors' hardware and software, advanced client/server capabilities and other new technologies. Software AG is also spending mightily on R&D (25% of revenues) in order to redirect its products into a client/server environment. And Legent Corp. is devoting some 20+% of its revenue to prepare for IBM's SystemView network management technology while also moving its formerly mainframe products into the client/server, Windows 3.0 mode.

Similarly, Charles B. Wang, chairman of number two software giant Computer Associates, says CA continues to focus its $173 million in R&D spending on the company's evolutionary CA90s software architecture, which is aimed at helping CA's customers implement interoperability. But it will be a long time coming. "We should have introduced it earlier than we did," he admits now.

Full implementation of CA90s will take years to complete, says Wang. Even so, he adds, CA users have shown great enthusiasm for the new architecture.

"I think the power and the cost—the economic things—are driving users toward this distributed world more and more," he says. "They've got to be heterogeneous because they cannot have the kind of thing where they are totally dependent on one vendor. We have to offer to our clients the ability to have portable solutions across multiple platforms."

The Evolutionary Approach

Like CA, most software vendors are offering users an evolution of their existing product lines, not a revolution in technology. Some 18 months ago, Atlanta-based Management Science America Inc. (MSA)—now a part of fifth-biggest software vendor Dun & Bradstreet Software Services Inc.—decided to move strategically away from its historical market of strictly mainframe financial, accounting and manufacturing applications. The move to the future, it determined, was to come via client/server computing. But it wasn't exactly an overnight delivery process.

"I hired [former McCormack & Dodge Corp. technical guru] John Landry back into the fold for the express purpose of migrating 14,000 customers at their own speed to client/server applications," says D&B Software chairman John P. Imlay Jr. A year and a half into the major R&D effort, Imlay is quick to concede that client/server computing is not a reality yet for D&B customers. "If you are on standard mainframe applications now, you'll add modules, and in three years you'll be client/server operation-

Welcome 1990's Newcomers

Who's new among the top 50 software vendors this year.

RANK 1990	COMPANY	TOTAL REVENUE 1990	1989	% CHANGE
8	Mentor Graphics	435.2	426.4	2.06%
10	Policy Management Systems	346.1	265.6	30.31%
15	CompuServe	238.9	203.1	17.63%
18	Cadence Design Systems	231.4	159.9	44.72%
32	Aldus	134.9	98.0	37.76%
48	J.D. Edwards	79.4	42.5	86.82%
50	Sage Software	70.0	62.0	12.90%

All revenue in $ millions

Ten Who Would Dare

Watch these 10 vendors—they're climbing fast.

COMPANY	TOTAL REVENUE 1990	1989	% CHANGE
Marcam Corp.	33.3	16.7	99.40%
Software 2000 Inc.	38.6	20.0	93.00%
Central Point Software Inc.	48.3	27.0	78.89%
Progress Software Corp.	40.1	25.4	57.87%
Ross Systems Inc.	40.0	26.1	53.26%
Consilium Inc.	32.4	23.1	40.26%
Unify Corp.	32.4	25.6	26.56%
Cadre Technologies Inc.*	53.0	42.0	26.19%
The MacNeal-Schwendler Corp.	56.6	45.0	25.78%
Interactive Systems Corp.	50.0	40.0	25.00%

* Privately held
All revenue in $ millions

ally—if you deem you want to be. It's a migration path."

Sterling Software is another among the many software companies that talk fast about new technologies but go slow in implementing them. In 21st place with sales of $207 million last year and R&D spending of $27.2 million, Sterling is working on a multitiered development project to make its software products interoperate across platforms using Windows 3.0 or OS/2 Presentation Manager-based user interfaces.

It is a complex, expensive and time-consuming effort, says Morton, which needs a balanced approach in the trade-off between enhancement and innovation.

Leapin' Ledgers!

After kicking and screaming for nearly eight years, the software industry has resigned itself to playing by new rules that could easily change vendors' positions in next year's Top 50.

The American Institute Of Certified Public Accountants (AICPA) is putting the final touches on its new guidelines for software revenue accounting. In a nutshell, the rules would prevent software companies from recognizing (booking) as revenue the entire support and maintenance portion of an initial license fee at the point when the contract is signed. Those dollars would have to be recorded piecemeal (prorated) across the term of the agreement, which often extends for a number of years.

The change in accounting makes no real difference in the amount of money a software company collects. But it could make a company's apparent short-term revenue and profit look smaller, making software companies unattractive to investors or customers who may not understand that the apparent performance drop is made of paper, not money.

As the new rules have come closer to confirmation, the American Software Association, a division of The Computer Software and Services Industry Association (ADAPSO), has lobbied for adjustments. Earlier this year, the ASA issued a statement of position on the rules that warned of "a disastrous impact on the American software industry and its ability to compete in a global market." But the AICPA's proposal is scheduled to go before the accounting community's standards-setting body—the Financial Accounting Standards Board (FASB)—in November. If approved by FASB, to take effect in fiscal 1992, software makers will have to take a deep breath, quickly retool their books and start explaining to investors, banks and stockholders.

Beyond the effect on the books lies a worry that software companies might be forced to make changes in their support practices to soothe the sting. "The concern is that people will get more inventive and creative in their business practices in order to avoid some of the difficulties," says Douglas Jerger, vice president of the ASA and a Certified Public Accountant. "That could cause some disruption of the relationships here." In particular, multiyear support agreements included with initial licenses may become scarce, according to Joseph Tibbetts, chairman of the Financial Practices Task Force of Price Waterhouse's Software Business Practices Committee.

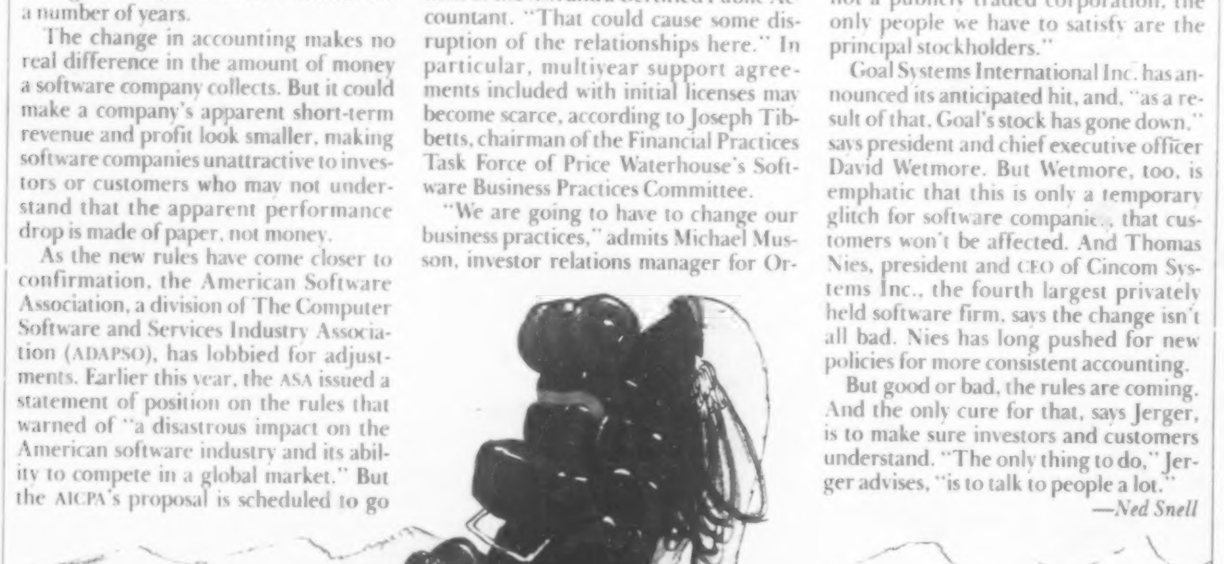
"We are going to have to change our business practices," admits Michael Musson, investor relations manager for Oracle Corp. Publicly held Oracle saw the change coming and bit the bullet last year, tweaking its accounting and support policies and taking a $53 million write-off to bring the books in line. Musson says that the impact on customers will be minor.

The ruling "doesn't affect our customers at all," agrees Stan Krejci, vice president for corporate operations and chief financial officer for Landmark Systems Corp. Landmark also adopted the new rules in 1990—despite the fact that they may be adjusted slightly before they take effect. "We certainly took hits to the bottom line," says Krejci, "but since we're not a publicly traded corporation, the only people we have to satisfy are the principal stockholders."

Goal Systems International Inc. has announced its anticipated hit, and, "as a result of that, Goal's stock has gone down," says president and chief executive officer David Wetmore. But Wetmore, too, is emphatic that this is only a temporary glitch for software companies, that customers won't be affected. And Thomas Nies, president and CEO of Cincom Systems Inc., the fourth largest privately held software firm, says the change isn't all bad. Nies has long pushed for new policies for more consistent accounting.

But good or bad, the rules are coming. And the only cure for that, says Jerger, is to make sure investors and customers understand. "The only thing to do," Jerger advises, "is to talk to people a lot."

—Ned Snell



The Fastest Climbers Of The 50

The fastest rising companies by percent growth.

RANK 1990	RANK 1989	COMPANY	TOTAL REVENUE 1990	TOTAL REVENUE 1989	% CHANGE
48	_	**J.D. Edwards**	79.4	42.5	86.82%
44	46	**KnowledgeWare**	92.3	50.1	84.23%
24	28	**Borland International**	190.8	104.4	82.76%
7	9	**WordPerfect**	452.4	281.4	60.77%
1	2	**Microsoft**	1,477.8	951.8	55.26%
37	38	**BMC Software**	116.6	76.3	52.82%
18	_	**Cadence Design Systems**	231.4	159.9	44.72%
47	43	**Micro Focus**	84.0	58.1	44.58%
40	41	**Symantec**	102.0	71.0	43.66%
35	37	**The Santa Cruz Operation**	119.0	83.0	43.37%

All revenue in $ millions

To keep customers up to speed, Dylakor and the other Sterling companies are phasing in a 20-stage new technology "Odyssey Project," as Sterling calls the effort. "Some of these stages will help our customers get to the future," says Morton.

As with Computer Associates's CA90s, and D&B's client/server efforts, the Odyssey project is no revolution. It is, instead, an evolution of existing products that will come on line in phases over the next several years. Users will have plenty of time to phase in each upgrade—if and when they choose.

And Sterling is not entirely certain that users will always choose to do so. Even though users say they want newer technologies, Morton points out, they also are sticking with the technologies they have already invested in, know well and can use most easily. "Software companies have a responsibility to protect the investment that clients have made in existing software," Morton says.

D&B
KNOWLEDGEWARE
OS/2

In fact, some of the fastest growing software vendors in the Top 50 are still selling, in effect, updates of basic older technologies. For example, J.D. Edwards & Co., whose revenues rose the fastest of them all, up by some 87% last year, just keeps on improving and selling its mainstream AS/400-based financial applications. KnowledgeWare Inc., the second fastest riser (up by 84%), is still selling IBM mainframe-based, COBOL-generating, computer-aided software engineering technology, which can now run under IBM's powerful OS/2 Presentation Manager operating system. WordPerfect Corp., fourth on the fastest growers' list, never even offered a Windows-3.0-based product last year, yet its customers kept coming back. Other mainstream vendors—including Boole & Babbage Inc., Cincom Systems Inc., Goal Systems International Inc. and Systems Center Inc.—also saw tremendous double-digit growth last year, sans client/server or Windows 3.0 technologies.

Ask vendors that are pushing into new technologies why they're doing so, rather than just improving existing systems, and they'll all tell you the same thing: customers already have the old, and now they want the new. "The drive seems to be coming from the user community," says Burton Grad, president of Burton Grad Associates, a systems consultant in Tarrytown, New York. "It's not something the software firms are particularly pushing."

But ask vendors how well they're doing in delivering these new technologies, and even they will give themselves mixed reviews.

"My personal view is they haven't done a good job," says Dylakor's Morton. "They can't. The technology is moving too fast."

Others says there are too many marketing gimmicks in the way of seriously advancing computing. CA's Wang says vendors have failed to evolve technology at anything close to an acceptable pace. "I don't think they're phasing [new technology] in," he says. "I think they are trying to obsolete the technology so they can sell it again." He points to IBM's software strategy as particularly troublesome. "Just look at PC-DOS and OS/2. Why is it that SQL on the AS/400 is different than the one on DB2? And why don't they put SQL on top of IMS? DB2 is just IBM's implementation of SQL on MVS. The answer is, they want to obsolete IMS."

Even the eternally optimistic Imlay of D&B Software is withholding judgment on how well the mainframe software companies are faring in delivering new technologies. "The jury is still out," he says.

"They're not as responsive as we would like to see," says Schabes of Citicorp. "We get responses like, 'Well, when the technology matures . . .' and 'In a few years . . .' We really need more honestly committed responses than we've been getting."

And she plans on being right out front to make certain the vendors know exactly what new technologies she wants and when. "The message we're communicating is: make this a very high priority of yours because we're making it a very high priority of ours." ▭

—With research by Susan Mael.

For a look at Software's Up & Comers see page 66

Software's Up And Comers

So who will rise out of nowhere and become the next Computer Associates International Inc., Lotus Development Corp. or Microsoft Corp? While the big guys grab for bigger and bigger pieces of the software market, a drove of small, hungry companies are beating a trail to users' doors by way of the latest in technology. The five companies profiled here have a good shot at making it onto DATAMATION's Top 50 Software Vendor list in the future, thanks to their ability to create innovative products and stay ahead of leading edge technologies. If they don't yet sound familiar to you, just wait a minute or two. Apart from a few Apple II Floating Point BASIC aficionados, who'd ever heard of Microsoft before 1981?

Inference Corp.
El Segundo, Calif.
Circle No. 225 on Reader Card

Inference Corp. is enjoying success in a market that few companies have prospered in: knowledge-based software. Inference designs, sells and installs knowledge-based development systems. Its main product, the Automated Reasoning Tool For Information Management (ART-IM) runs on everything from DOS and OS/2 PCs to mainframes under MVS. The company has an installed base of over 13,000, including customers like American Airlines Inc., Dun & Bradstreet Corp. and Nippon Steel Corp. Revenues for fiscal year 1990 topped $15 million, and the company is looking to break $18 million in 1991.

The company's latest product is called Case Based Reasoning (CBR) Express/Windows, a Microsoft Windows-based front end into the ART-IM system for quick application development on PCs running Windows.

PeopleSoft Inc.
Walnut Creek, Calif.
Circle No. 226 on Reader Card

Client/server! Graphical User Interface! Windows! Almost all software on the market has been emblazoned with these monikers since the GUI revolution began with Microsoft Windows 3.0 last year. All, that is, except for the lowly cog of corporate software—human resource packages. But PeopleSoft Inc. wants to change all that.

The company launched a line of HR software—payroll, benefit administration and human resources—that operates under Windows and ties to corporate databases through a Structured Query Language (SQL) interface.

PeopleSoft has been shipping client/server HR systems on local area networks and mainframes since 1989 and boasts more than 50 *Fortune* 1,000 customers.

Powersoft Corp.
Burlington, Mass.
Circle No. 227 on Reader Card

In March, Powersoft Corp. introduced PowerBuilder, a Windows 3.0-based SQL front-end development environment that's designed to be used by teams of programmers. It has proven to be a hot seller for the company because it lets programmers choose between using a traditional procedural language or an object-oriented, event-driven approach to building client/server applications. PowerBuilder doesn't require mainframe developers to relearn programming on the PC: it looks and feels like a mainframe system, only it runs under Windows.

Dun & Bradstreet Software Services Inc. liked the PowerBuilder tools so much it's buying into the company. The old-line mainframe software vendor announced in July that it will use PowerBuilder to add Windows-based client applications to its mainframe-based human resource and financial software. That could generate $20 million in revenue for Powersoft over the next five years.

Servio Corp.
Alameda, Calif.
Circle No. 228 on Reader Card

Servio Corp. introduced the first commercial object-oriented database in 1987 and hasn't slowed down since. The company began in 1982 as a research and development organization for object-oriented database technology and has since become one of the leading vendors.

Servio introduced version 2.5 of its GemStone object-oriented database server in February. GemStone uses object-oriented technology to store data in the form of sound, graphics and images. The database caught the eye of IBM, and in March Servio agreed to port the database to the RS/6000 workstation. In May, the company was named an IBM business partner to sell RS/6000s bundled with the GemStone database system.

So what's next? Ties to other databases and new platforms, Servio says. GemStone currently runs on DEC VAX/VMS machines and UNIX platforms.

The Whitewater Group
Evanston, Ill.
Circle No. 229 on Reader Card

When many PC software developers think of object-oriented programming (OOP), they think of The Whitewater Group. Since its founding in 1985, the company has specialized in OOP. The company is so good at OOP, that Borland International Inc.—a company that constantly touts its own OOP capabilities—sought out Whitewater's expertise when developing the Windows 3.0 versions of its products. The two companies have created ObjectWindows, a multivendor library of routines.

Whitewater's flagship product, Actor, is an object-oriented programming tool for building Windows applications. Recent additions to the company's line include Actor Professional, which comprises Actor and two tools—ObjectGraphics, an object-oriented graphics library, and the Whitewater Resource Toolkit, a Windows screen-painting tool. New this year is WinTrieve, a database-like file manager for Windows.

—Mike Ricciuti

POWERSOFT
WHITEWATER GROUP

■ EUROPE

Why Leased Lines Cost So Much

Crossing a border with a leased line can be a shock to the budget. But competition is bringing prices down, and new regulations may make them more manageable.

BY MARSHA W. JOHNSTON

"Wide-area networking in Europe is going to be a disaster unless the PTTs can somehow learn to work together," declared David O. Williams from the podium of a recent conference on future computing architectures.

"To lease a 64-Kbit line from Glasgow to Oxford costs me *x* pounds per month. To put in the same line from Oxford to Geneva, which is 50% further, is 15 times more expensive per month," says Williams, who is leader of the computing and networks division of CERN, Europe's particle physics research lab, based in Geneva. His concern about the cost of cross-border networking on 64-kilobit-per-second leased lines provided by the Post, Telephone and Telegraph agencies was echoed repeatedly at the conference by users and computer vendors alike.

In fact, the cost for a 320km-long leased 64Kbps line that crosses two borders can be as much as 20 times higher than a comparable line in the United States, says Audrey Mandela, vice president, international, for Yankee Group Europe in Watford, U.K. She adds that a domestic leased line in the United Kingdom does not cost that much more than it does in the States.

The Culprit

The higher cost of cross-border leased lines clearly has little to do with the cost of the technology and more to do with differences in the cost structures of the various national service providers.

Europe's tariffs are set "to the maximum the market will stand within the business objective of the PTTs," says Brian Gray, vice president of network equipment vendor Timeplex Europe/Africa in Slough, U.K. He adds that there is no technical reason why they should be different from country to country or higher than those in the United States.

Although there may be some costs involved in connecting equipment from different vendors when crossing borders, Yankee Group's Mandela believes Europe's widely varying tariff structures have more to do with whether the PTT is part of the government and, as such, is expected to subsidize another part of that government. Before deregulation in Germany, for instance, the telecom division of the Deutsche Bundespost subsidized the postal service, she points out.

A leased line in the U.K. doesn't cost much more than it does in the States.

Countries with antiquated infrastructures, like Italy and Spain, have higher tariffs because they need a lot of money to modernize them, Mandela notes.

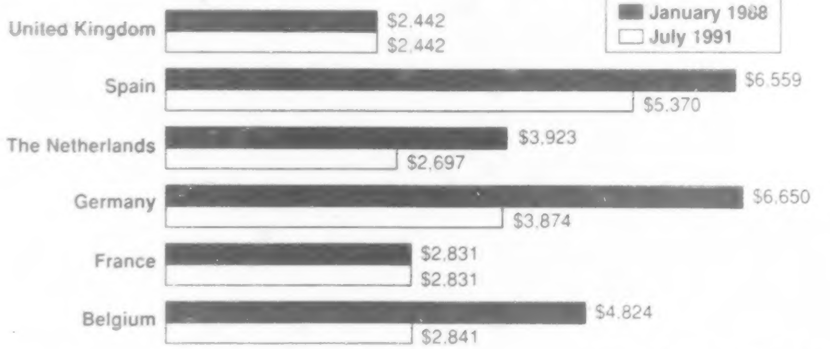
Charging more for specialized services is another way to subsidize inefficient infrastructures, says Mandela. "In Spain, they have increased tariffs for certain services such as mobile [phones] because [otherwise] it's too expensive for them to provide the service," she says.

Trying to avoid high tariffs in certain regions of Europe can create extra costs for users. "Say you have headquarters in Spain and another major site in France, and you're trying to decide, on a European basis, where to centralize your communications activities," explains Ben Bovum, European group IS manager for London-based foodstuff-producer Cargill PLC. Making the decision requires looking at the available skills and the cost and availability of services. "Spain is more expensive, and the skills you need are, maybe, less available. And so Spain could end up being a remote site, even if it makes more sense to have the center there because it is closer to your business activity," Bovum says. As a result, he adds, you may decide to pay more to install extra backup capability on the link to Spain, since it carries critical information.

Despite the confusing variations in leased-line tariffs, relief for users is com-

A Tangle Of Tariffs

Although prices have come down sharply in many countries, the monthly rental charge (in U.S. dollars) for a 64Kbps half circuit to Sweden, as of July 1991, still varied by as much as 120% from country to country.



Source: Tarifica Service/Logica

ing from a couple of quarters. Competition among the PTTs, from other telephone carriers and from the users themselves is pushing prices down in many countries. A British Telecom spokesperson, while acknowledging that there is a wide variation in tariffs, also says that there is an increasing movement toward prices that more directly reflect the cost of providing the service. The Commission of European Communities, aware of the role international leased lines can play in making unified Europe a bigger industrial power, is moving to introduce regulations that would make the rates more uniform and more cost-based.

Already, as Cargill's Boyum says, European tariffs are moving rapidly and going "mostly in the right direction—down." In fact, a sampling of data from the London-based research house Tarifica Service/Logica Ltd. shows that in seven European countries the majority of monthly rental charges for a 64Kbps half circuit has dropped significantly since January 1988. (A half circuit begins at one carrier's international gateway and ends at the midpoint on the leased line between the two countries involved. Each PTT, therefore, levies its part of the monthly charge.) The cost of a 64Kbps half circuit to Sweden, for example, from Germany or Belgium has dropped by 41% between January 1988 and July 1991. From The Netherlands it has dropped by 31% and from Spain by 18%.

Europe's tariffs are set to the maximum the market will stand.

■

The trend toward more competition for the national carriers picked up steam in April with the arrival of Tele2 AB, an independent rival to the Swedish national PTT, Televerket (see sidebar, "Sweden Sweetens The Competitive Pot"). In Britain, competition from Mercury Communications Ltd. has contributed to an overall drop in service and line charges at British Telecommunications PLC, including a 17% drop in per-kilometer charges for 64Kbps leased lines last spring. More recently, in August, BT dropped its international phone charges by as much as 20%.

Even without a second national carrier, Yankee Group's Mandela predicts, the existing PTTs in countries like France or The Netherlands will continue to drop their international circuit charges over the next three to four years, as they install more cables throughout Europe. With the extra capacity, these carriers will try to lure international businesses into using their countries as hubs for wide area networks.

Europe's national carriers are also keeping an eye on foreign competition. AT&T, for instance, is building a network across 17 European countries to compete with the PTTs for packet-switching and managed network services such as electronic data interchange (EDI) and e-mail. And Mandela points out, "it's a 2-megabit-per-second network with NET [Network Equipment Technologies Inc.] multiplexers, so it could be used for anything," including leased lines.

Competition From Users

Nevertheless, she believes, competitive pressure on the PTTs is more likely to come first from users reselling extra capacity. In fact, she adds, if the PTTs don't cut their tariffs on international leased lines, their own users may just steal away their business. The Consultative Committee On International Telephony And Telegraphy (CCITT) is amending its guidelines for leased-line use to endorse the concept of users reselling their excess capacity to other companies. In the wake of such a political sea change, which is expected to take effect sometime this year or early next, Mandela says, "there should be some international resale on those routes, which should help drive down the cost."

Meanwhile, a draft of the Commission's new Open Network Provision (ONP) directive is moving slowly through the legislative process, which could take another nine months.

The provision's directives calling for cost-oriented tariffing, as they currently stand, favor users. Although they could be watered down in the legislative process, it is thought unlikely because the current directive is a revision of a first draft that was widely criticized as heavily favoring the PTTs. A 1991 Yankee Group report on reregulation in Europe concluded that the provision, in its current form "would transform the conditions under which leased lines are supplied in Europe and represents a major success for the Commission."

Trying to avoid high tariffs in certain regions can create extra costs.

■

Indeed, as Mandela sees it, the Commission's direction is clear. "In the last couple of years, they have made it clear that their policy will be to make tariffs as close to cost based as possible. [And] there has been a push by the Commission for transparency in tariffing. They're not saying tariffs should be the same, but that they should be easy to understand and take apart by the user. The Commission just wants to make sure an enormous profit margin is not being gouged out of the users." ▭

Sweden Sweetens The Competitive Pot

As only the second challenger to a national telephone carrier in all of Europe, Sweden's Tele2 is eying cost-based tariffing but says it will be driven above all by the need to provide a greater variety and quality of services to the market.

"Our objective is to compete with the service quality of everyone. We don't think the customer is interested only in getting cheaper service," says Kjell Nilsson, sales director for Tele2, a joint venture between Sweden's Industriforvaltnings AB Kinnevik and Britain's Cable & Wireless PLC. Cable & Wireless is the founder of the only other challenger to the national Post, Telephone and Telegraph (PTT) agencies, Mercury Communications Ltd. in the United Kingdom.

The new fiber-optic network is being installed under a 25-year agreement with the Swedish Railroad Administration. In its first phase of operation, scheduled for the beginning of next year, it will cover a triangular area around Stockholm that contains about 80% of Sweden's population.

Tele2 has already implemented a public Transmission Control Protocol/Internet Protocol (TCP/IP) network service for LAN-to-LAN communications and will add an X.25 service open also to Systems Network Architecture (SNA) communications this month or next. It will offer 64Kbps and other international leased digital lines in the second quarter of 1992.

MARKET INSIGHTS

AN ANALYSIS OF ECONOMIC TRENDS

Hopes Dashed, Upturn Postponed

BY MADELINE FRANCHI
Cahners Economics

Tough times continue for the information systems industry. The DATAMATION Information Systems Performance Indicator (ISPI) edged downward to 93.4 in June from a revised 94.12 in May. As of October, it hovers at a predicted 97. New orders for IS equipment dropped sharply from May to June and took a nosedive of 6% relative to a year ago. That's the worst performance the industry has seen since mid-1986. Such news always discourages would-be investors, which continued to hold back growth in the high-technology stocks. That also holds back growth of our ISPI.

The good news in all this is it could be worse: the indicator once fell even further, back in November of 1986, when it hit a low of 88.24.

Furthermore, IS manufacturers see a few signs that could indicate an upturn. Inventories in June ($15.47 billion worth) shrunk so low they'll have to turn up soon just to meet today's modest level of demand.

Encouraging signs are also popping up among the data on the number of average weekly hours worked by computer industry employees. Average hours increased steadily from April through June.

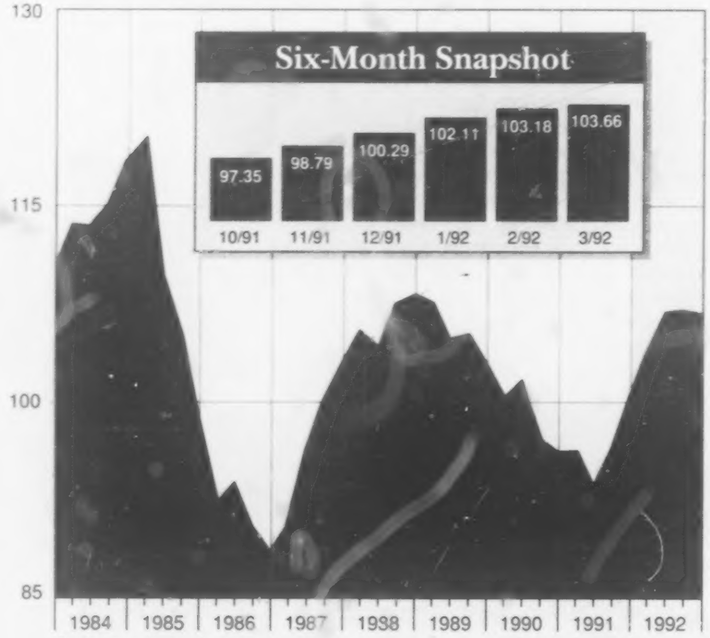
If that's the good news, what's the bad news? The ISPI's low level could also mean the IS industry is poised for a later rebound than we had originally expected. But until more data come in, we're sticking with our forecast for an upturn beginning in next year's first quarter.

Although computer manufacturers will begin to sense some uplift late in this quarter, they won't feel the full force of recovery until late in 1992 or early in 1993.

For more information on Cahners Economics's forecasting services, including seminars, newsletters and database diskettes, call Dan Buchan at (617)-630-2105, send him a fax at (617)-630-2100 or write to him at Cahners Economics, 275 Washington St., Newton, MA 02158.

The IS Performance Indicator

The IS manufacturing industry is a little weaker than expected.



*Shaded area denotes forecast

Source: Cahners Economics

	June 1991	May 1991	% Change 6/91-5/91	June 1990	% Change 1990/1991
■ **Information-Processing Equipment**					
Shipments (SA, $ billions)	9.40	9.47	-0.8	9.40	0.0
New Orders (SA, $ billions)	9.30	9.48	-1.9	9.90	-6.0
Unfilled Orders (SA, $ billions)	27.99	28.08	-0.3	27.96	0.1
Inventory (SA, $ billions)	15.47	16.04	-3.6	16.79	-7.8
■ **Computer Production Workers**					
Employment (NSA, thousands)	265.6	266.3	-0.3	281.0	-5.5
Average Weekly Hours (monthly avg.)	41.3	40.3	2.5	42.0	-1.7
■ **Stock Index**					
S&P's Computer Systems Stock Price Index	164.6	167.6	-1.8	193.7	-15.0
■ **Contracts & Orders**					
New Plant & Equipment (SA, $ billions)	34.0	33.4	1.6	37.7	-9.8

SA= seasonally adjusted;
NSA = not seasonally adjusted

Source: U.S. Commerce Dept., Standard & Poor's forecasts, Cahners Economics

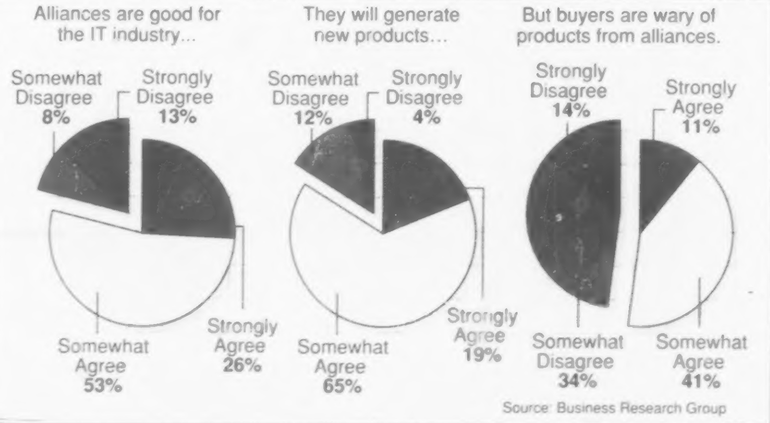
MARKET INSIGHTS

A SURVEY OF TECHNOLOGY TRENDS

IS Managers Favor More IT Alliances

BY WARREN CHILDS
Business Research Group

Business Alliances, Yes; Joint Products, Maybe



Source: Business Research Group

The U.S. information technology industry is finally catching onto Japan's not so secret success strategy: strong competitors make good allies. Just take a look at events of the recent past: IBM inks an alliance with Apple Computer Inc.; The Santa Cruz Operation Inc. signs a binary-compatibility pact with UNIX System Laboratories Inc.; and IBM, Digital Equipment Corp. and Hewlett-Packard Co., competitors all, agree to work together to build the Open Software Foundation's distributed-computing products.

What do IS managers think of this new competitive buddy system? They think it's great—with reservations.

In our latest survey of the DATAMATION Technology Panel, respondents came out overwhelmingly in favor of alliances; more than 80% of panel members believe alliances will generate new products and services that might otherwise not be available.

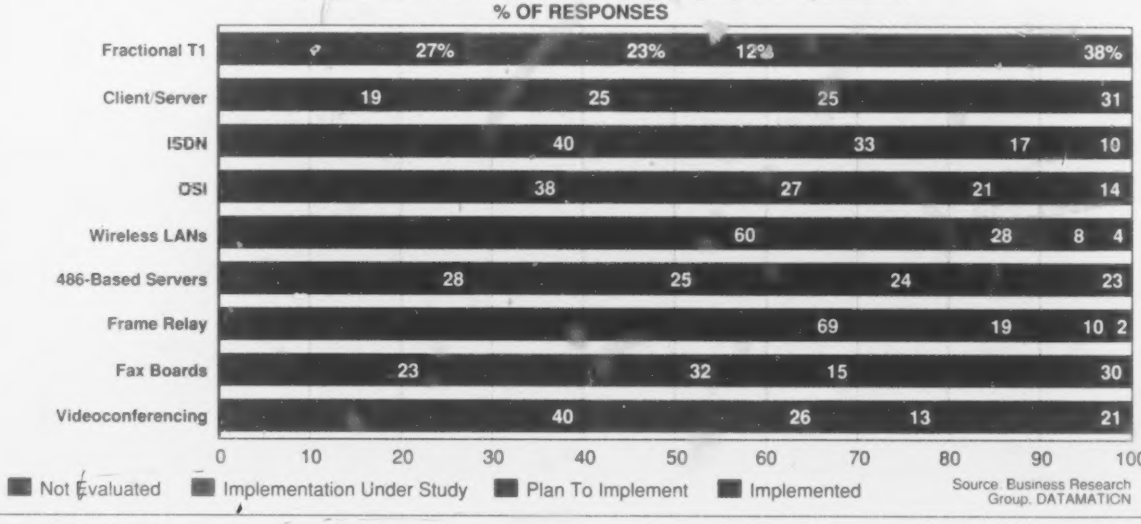
Panel members predominantly agree that alliances are for the good of the industry and will make U.S. products more competitive with those of Europe and Japan. Only one-third agree that government should look more closely into alliances between technology companies.

But, when it comes to their own suppliers, panel members still have some reservations about such alliances. More than half agree that they would be more cautious when acquiring products born of alliances. Questions they raise include: Will there be a single point for product support? What is the long-term stability of the alliance? And what if one partner leaves?

For more information, call Nancy Finn at (617)-964-6204, send her a fax at (617)-558-4402 or write to her at the Business Research Group, 275 Washington Street, Newton, MA 02158.

DATAMATION's Technology Implementation Index: Networks/Communications

DATAMATION each month surveys a select group of its readers--the DATAMATION Technology Panel--to investigate the implementation of new technologies by key user organizations.



Source: Business Research Group, DATAMATION

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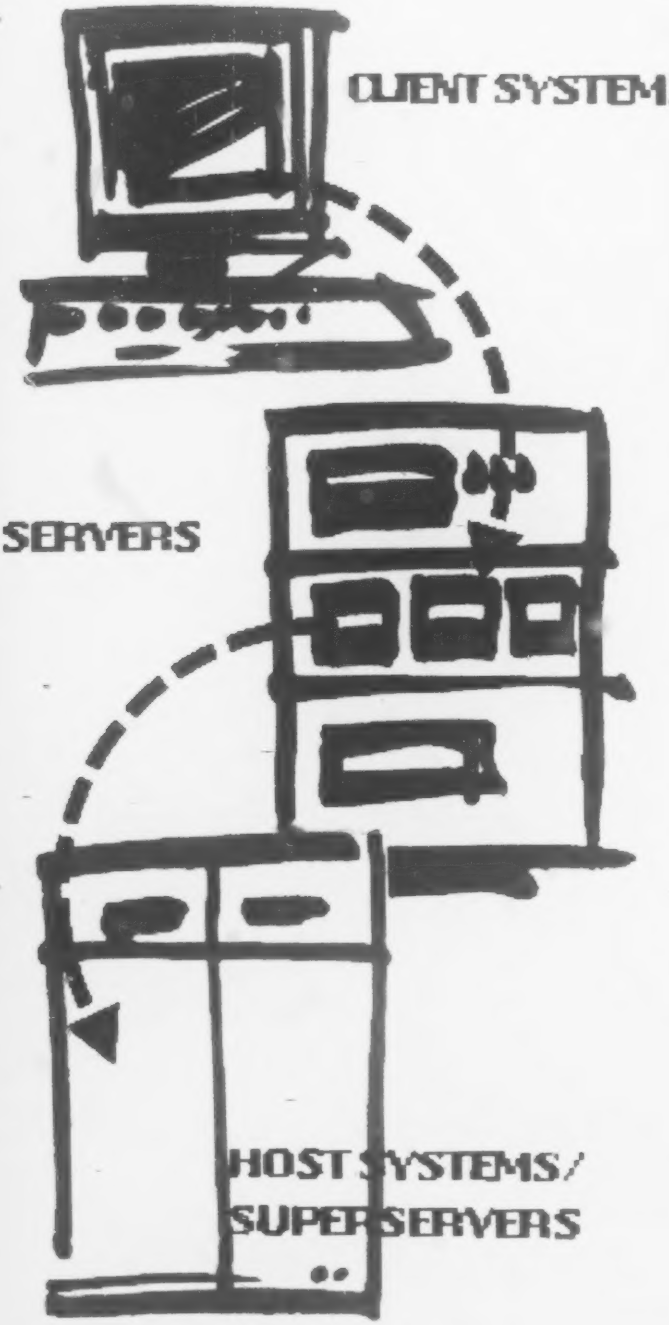

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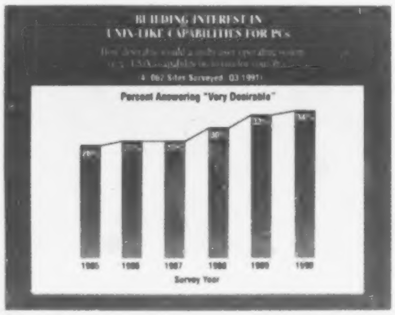

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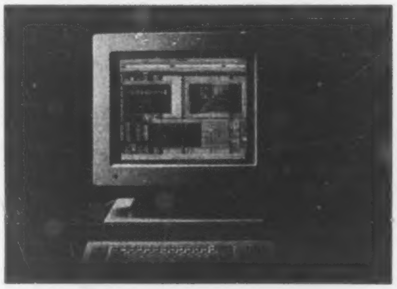

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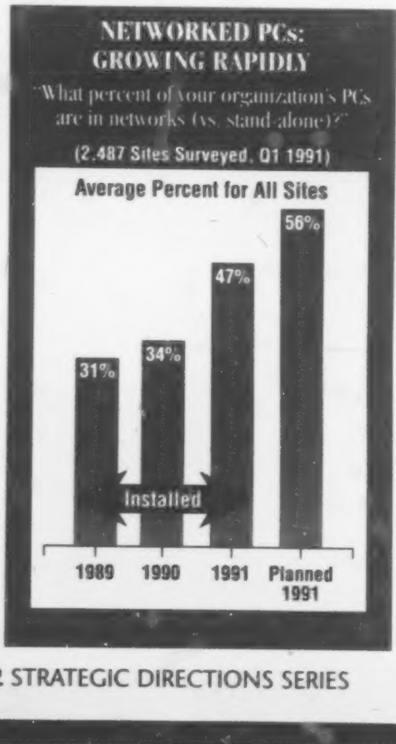
The Best in Client/Server Computing!

Exploring the evolution, implementation and real-world benefits of the IS technology that will dominate the 1990s

Three inescapable forces are converging to thrust information systems (IS) managers toward client/server computing:

- *Technological:* the power of today's desktop systems—coupled with advances in networking, relational database software and graphical user interfaces—are enabling organizations to use personal computers (PCs) and workstations for true corporate information processing.
- *Economic:* IS managers are under pressure to lower costs even as they improve and increase the enterprise's information processing capability.
- *Organizational:* IS managers are charged with creating flexible systems that boost the productivity of revenue-generating and cost-saving employees.



NETWORKED PCs: GROWING RAPIDLY

"What percent of your organization's PCs are in networks (vs. stand-alone)?"

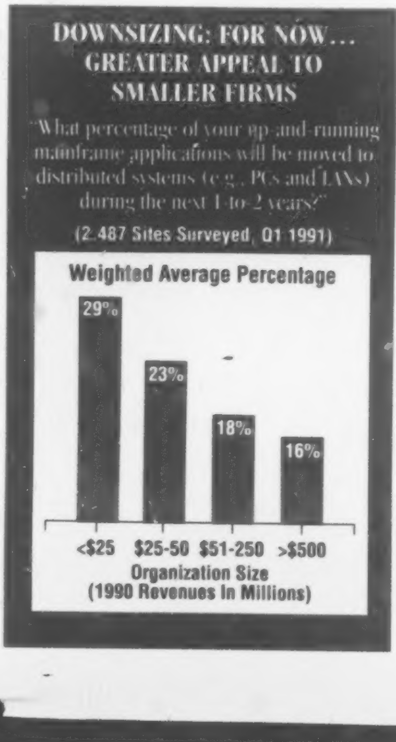
(2,487 Sites Surveyed, Q1 1991)

Little wonder, then, that IS managers are moving swiftly toward client/server computing. Regardless of industrial, financial or geographic particulars, more and more organizations are downsizing from host mainframe architectures to make better use of the power of PCs and workstations and counter the isolation of important company data on PC networks, undertaking multivendor network integration, or shifting away from inefficient timeshared systems.

What do these organizations get for their efforts? Significant improvements in both end user and IS productivity. Information system consolidation. Better access to information technology. Eventual decreases in operating costs. Improved control of corporate data. An ability to create new corporate products and services. New kinds of IS applications.

"Downsizing enables an entirely new class of applications," says Chuck Sullivan, vice president of marketing at Channel Computing, the Newmarket, NH-based maker of *Forest & Trees,* a client/server-oriented data access and monitoring tool. "It's possible to provide people with the information they need to run their business—right at their fingertips."

The numbers of PCs that are in networks rather than in



DOWNSIZING: FOR NOW... GREATER APPEAL TO SMALLER FIRMS

"What percentage of your up-and-running mainframe applications will be moved to distributed systems (e.g., PCs and LANs) during the next 1-to-2 years?"

(2,487 Sites Surveyed, Q1 1991)

standalone mode have been growing dramatically for several years. But that is only a first step toward the productivity possible with client/server computing, an architecture which enables organizations to develop and run applications on PC-, Macintosh-, workstation- or minicomputer-based networks that support the same robust integrity, security and database facilities of traditional mainframes and minicomputer systems. Client/server software—unlike file-based network computing—affords secure and concurrent multiuser access to shared databases.

But because client/server computing indelibly affects not only the way an organization's IS operation functions but the way *all* departments, workgroups and employees do their jobs, both end user interests and needs as well as IS concerns must be addressed if client/server computing is to deliver its promise.

Planning for the Future with Sun

The Port of Singapore is one of the busiest in the world. Its ship planners, like air traffic controllers, must contend with myriad details—ship and truck schedules, stack weight and refrigeration needs, legal constraints such as crane clearance and trim and stability requirements—all in an effort to minimize turnaround time and keep shipyard operations running smoothly.

As the port grew, the tasks facing the ship planners became too complex for the mainframes they had relied on since the 1970s. Working closely with Singapore's Information Technology Institute, the port's computer experts designed artificial intelligence software to automate container, crane and transportation and storage-facility allocation, as well as generate loading and unloading schedules.

The software, implemented on a network of Sun Microsystems *SPARCstation* and *SPARCserver* systems linked to an IBM mainframe, mirrors as closely as possible the planners' own decision-making processes, helping them prepare stowage profiles and run crane operations. Onscreen, the workstations allow objects to be dragged and dropped, saves statistics and alternate plans for later use, and maintains a database on all shipping operations.

> *"The Sun network has helped increase productivity by more than 30% a year."*

The Sun network has helped increase productivity by more than 30% a year because planners have more time to resolve fast-breaking problems and can move ships in and out of port more quickly and safely—saving both time and money.

"The system paid for itself within six months," reports Ang Chong Hoat, assistant manager in the port's cargo systems department. "And that doesn't take into account an estimated $30 million savings in staff costs over the next three years, thanks to increased planner productivity."

"It's been so successful," he continues, "that we are now working on four other systems to help automate other port activities. Eventually, nearly every activity in the port will be run by similar systems. Client/server networks like Sun's are the only sensible technical solutions today."

Sun Microsystems

What Kind of Client/Server Computing Will Do the Most For You?

Not all client/server computing models offer the same advantages. What is the ideal client/server scheme ?

- It uses workstations and servers powered by a non-proprietary RISC processor.
- Its open UNIX operating system is paired with an open networking protocol like *ONC/NFS.*
- Since interoperability with other systems is so important today, it offers broad connectivity, regardless of computer type—linking with proprietary IBM and DEC systems, PCs from any vendor, or even a supercomputer.

- And this solution has an intuitive graphical user interface such as OPEN LOOK that simplifies operation via point-and-click and drag-and-drop mouse controls.

While this open, standard solution allows scalability from the low to high end, it also lets users access information located anywhere on the network—on a mainframe, a minicomputer, a PC, or a workstation from a different vendor—whether the machine is located across the hall or across the globe. Rather than helping *individuals* become more efficient, this client/server model improves the results of the entire organization. That's because in this 'distributed computing' scheme, people and their work are linked to everyone else, sharing and sending information in milliseconds.

Using this client/server approach, an organization is assured of a productivity solution that integrates easily into an existing environment, thus preserving investments—both in equipment and people. There's no more fear of obsolescence. However, this solution also delivers an affordable, powerful growth path for many years. The bottom line is that companies adopting client/server computing improve productivity while gaining competitive advantage to succeed in their market.

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Motorola Commercial Systems Division

Seamless Client/Server Computing

Motorola's Commercial Systems Division (CSD) believes the computer companies of the 1990s will have to compete on quality, high performance, pricing, adherence to industry standards and the ability to add value to new or existing commercial computing solutions. In addition, users today want all of their hardware and software choices to work together seamlessly and to be easy to install and use. CSD provides computing solutions and integration services that make this possible.

CSD's historic pursuit of standards in product development have put the company in the vanguard of open systems in the 1990s. The company's *MultiPersonal Computing* environment—a networked office environment that allows easy integration into networks of heterogeneous systems—enables applications to be shared seamlessly regardless of operating systems or microprocessor architectures. The company's RISC-based servers are so 'open' that they can act as powerful engines not only for Motorola networks, but for any existing networks. Graphical user interfaces make interaction between user and computer as simple as point-and-click.

CSD's unequaled array of standards-based hardware and software products enables the company to provide an extensive level of systems integration for large bid orders. An independent software vendor (ISV) program ensures a steady stream of industry-leading applications, and CSD's active value added reseller (VAR) program generates a diversity of vertical applications for many commercial industries.

Circle 602 on Reader Card

This Strategic Directions Special Edition, the first of several to be published by *Datamation*, explores those interests, needs and concerns. To do so, a spectrum of demand-side market research has been tapped:

- Cowen & Co.'s institutional services division conducted two comprehensive studies of *Datamation's* readers in the third quarter of 1990 (4,062 survey participants) and the first quarter of 1991 (2,487 participants) that point to the growing reach of client/server computing for North American enterprises.

Downsizing Helps Motorola Compete

When a competitor threatened Motorola Cellular Subscriber Group's (CSG) market share by introducing the first $700 cellular portable phone, CSG was able to build a competing product in 20 days. And its IS group had a product support environment, complete with 800-number and credit card ordering, up and running in only three weeks.

According to Greg Goluska, director of MIS for the CSG, the ability to respond quickly is a direct result and primary benefit of downsizing from an mainframe environment to a distributed environment that includes RISC- and CISC-based systems made by Motorola's Computer Group.

"A distributed environment has meant a five- to ten-fold increase in programmer productivity. We could never have had the programs necessary to support the product developed on time working in a mainframe environment," says Goluska.

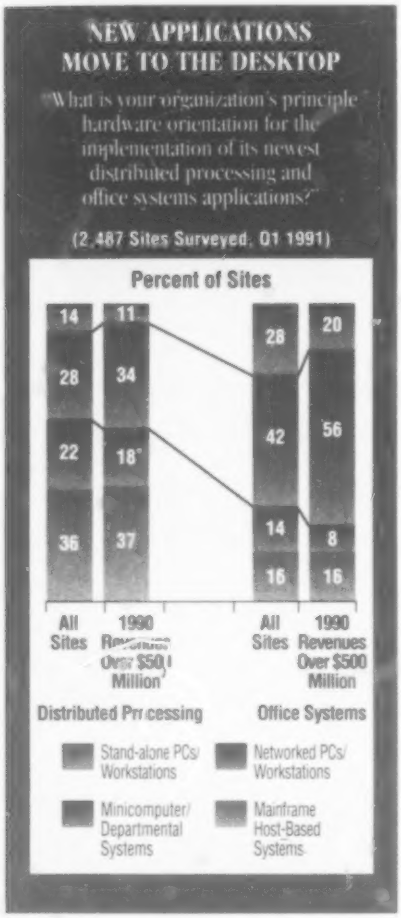
> *"The biggest benefit I see is the ability to handle change."*

To compete in the fast-paced cellular phone business, all projects are completed in a four-month cycle. Goluska estimates there is a 50% chance that something taking longer than four months to develop will not fit the needs of the business by the time it is completed. Unlike the old static mainframe, the distributed environment allows IS to be flexible and accommodate the changes taking place in the company's operations.

"The biggest benefit I see is the ability to handle change," says Goluska. "Unlike other businesses which are driven primarily by technology, the cellular telephone business is market-sensitive. Product and service life cycles are shorter and constantly changing and IS has to be able to react to this change. In fact, whatever dynamics drive product development should also drive information systems development."

In addition to flexibility and capacity for quick response, downsizing has become critical to CSG's bottom line. Because the costs of cellular telephones are declining so dramatically, in order to double sales revenue CSG must *triple* its sales volume without tripling staff spending.

"The care and feeding of a mainframe gets expensive because you must have a number of systems programmers dedicated to maintenance," Goluska points out. "And adding functionality would mean buying another mainframe and dedicating more people to that system. In a distributed computing environment, whenever we want to add more functionality we simply add a processor. And only a processor."



NEW APPLICATIONS MOVE TO THE DESKTOP

"What is your organization's principle hardware orientation for the implementation of its newest distributed processing and office systems applications?"

(2,487 Sites Surveyed, Q1 1991)

- Business Research Group (BRG), a Cahners Publishing Co. subsidiary specializing in user demand-oriented market research, has undertaken several highly-focused surveys over the last year that unearth vital details about Fortune 1000 IS and end user executives' implementation plans for client/server computing.

Client/Server Computing Defined

Although there is tremendous diversity of opinion among those constructing client/server systems as to just what constitutes client/server computing, a couple of points of agreement can be discerned:

- Client/server computing requires a network linking at least two computers and the interaction between these machines results in some kind of synergy.
- Client/server computing is an enabling technology: applications must be written for it if it is to be truly effective.

BRG's queries of Fortune 1000 IS and end user executives who are implementing client/server systems produced many definitions; they fell roughly into four categories:

- Applications offering file- or peripheral-sharing or remote computer access.
- Applications that disseminate a database among more than one computer on a network.
- Messaging applications, such as electronic mail.
- Processing-intensive applications that distribute different computing tasks among connected computers.

BRG has defined client/server computing as *a system in which application processing is shared between a desktop 'client' and one or more network-attached 'servers.'*

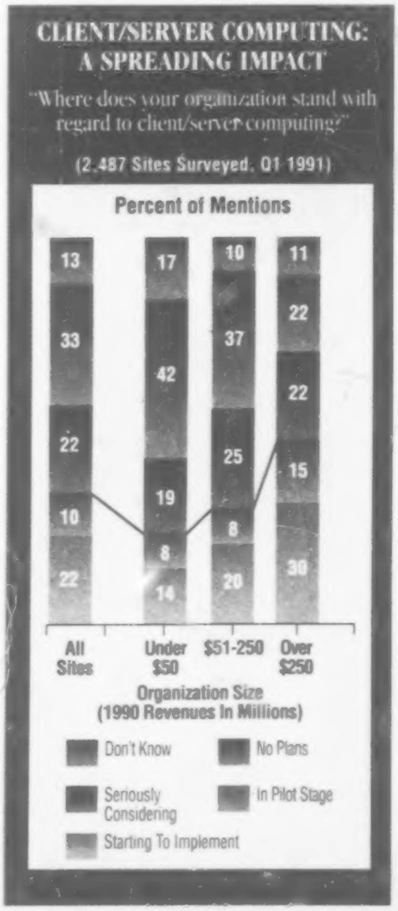
"Successful client/server computing," believes TechGnosis, Inc.'s director of marketing, Keith Toleman, "requires the freedom to choose *any* hardware, operating system, database management system or development tool set." Each component of the system handles the tasks for which it is best suited and end users can easily access programs and data without knowing, logically or physically, where the networked resources are located.

"Unlike traditional cluster computing that has a limited capacity, client/server systems are infinitely expandable—additional hardware and applications can be added to the network as they are needed, without replacing existing hardware," notes Wayne Sennett, corporate vice president and general manager of Motorola's Commercial Systems Division.

Client/Server Parts

The components of client/server systems are nearly always linked by a local area network (LAN). LANs themselves can be connected by wide area networks (WANs); WANs allow an organization to construct an enterprise-wide network of workgroup, departmental and site-based LANs.

For those who need to link their networks to mainframes, gateway products have been developed. Rabbit Software, for example, offers *RabbitSTATION* and *RabbitGATE* for connectivity between IBM mainframe environments and PCs, PC/LANs and workstations. Rabbit's *Open Advantage* products provide



CLIENT/SERVER COMPUTING: A SPREADING IMPACT

"Where does your organization stand with regard to client/server computing?"

(2,487 Sites Surveyed, Q1 1991)

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Sterling Software
Right-sizing for a Multi-Platform Environment

Sterling Software's view of client/server computing is specified in its Corporate Applications Management Initiative (CAMI). CAMI is a complete life cycle environment that enables the "right-sizing" of applications consistent with AD/Cycle and SAA—while embracing both IBM and non-IBM platforms.

Right-sizing, as defined by Sterling Software, means that the client portion of client/server applications for new or reengineered applications does not run on the mainframe. Data, however, may be located on the mainframe and sup-

plied to the client by mainframe-resident servers or managed by SQL servers.

Sterling Software believes that the economics of LANs, workstations and minicomputers—and the increased utility of applications—make right-sizing an attractive option. However, corporations cannot ignore the fact that a majority of corporate data is located on its mainframes. This fact, combined with a heterogeneous computing environment, has led Sterling Software to develop multi-platform client/server solutions.

Currently supported client platforms for right-sizing include end user systems based on DOS, Windows, OS/2, Presentation Manager, LANs and UNIX, and departmental systems including Tandem Guardian and Informix. On the server side, Sterling supports data access from these client platforms to all mainframe databases, including DB2, IMS/DB, VSAM, SQL/DS, DL/1, ADABAS, IDMS and others.

For further information, contact:
Amy Ballou
Senior Marketing Manager
Sterling Software, Inc.
Answer Systems Division
5900 Canoga Avenue
Woodland Hills, CA 91367
818/716-1616, extension 273

Circle 600 on Reader Card

emulation of 3270 and remote job entry terminals for UNIX environments.

Servers can be mainframes, minicomputers, workstations or personal computers. Sun Microsystems, for instance, offers a server family based on a reduced instruction set computing (RISC) architecture and the UNIX operating system—called *SPARCserver*—that handles workgroups of 10 to 80 networked clients. The choice of server depends on system size and deployment as well as the kinds of functions servers will perform, the type of application environment in which they will run and an assessment of how the client/server system will need to evolve with the organization it serves.

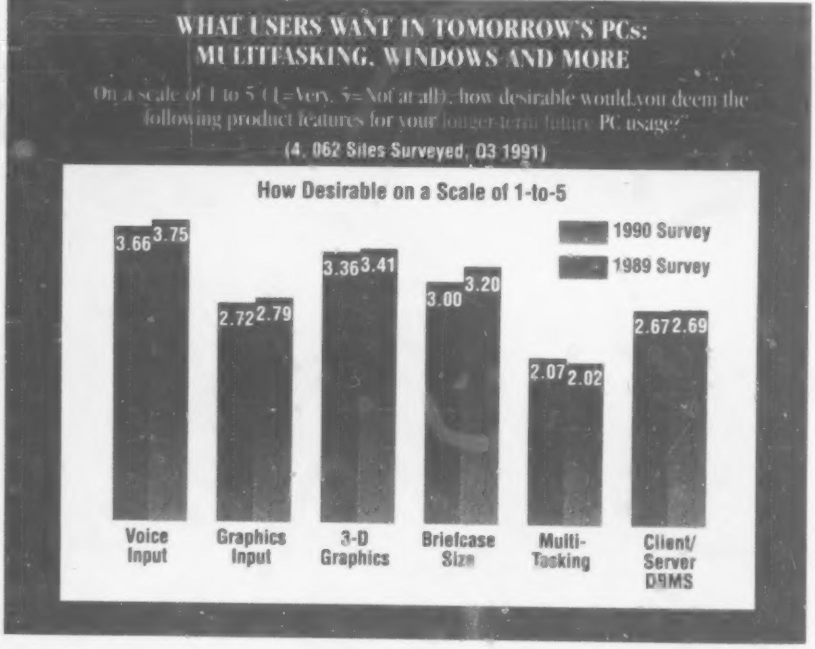
PCs and workstations also function as clients. Sun Microsystems' *SPARCstation* line of clients ranges from the low-cost *SLC* model to high-end graphics workstations for image processing and scientific visualization. Even dumb terminals can be useful in a client/server environment. All manner of peripherals, too, can be linked via client/server-oriented LANs. Often, products from several vendors must perform together on one network.

Motorola's Commercial Systems Division, for example, markets the RISC/UNIX-based *MultiPersonal Computer (MPC)* family, which supports various workgroup sizes and can simultaneously act as a LAN server for installed PCs and Macintoshes.

What Servers Do

Indeed, BRG research indicates that peripheral sharing is the most common function of LAN servers. But it certainly isn't the only one. Servers also handle such activities as:

- File sharing
- Storage and retrieval, including electronic mail and voice mail store-and-forward
- Network and document management
- Gateway functions, including gateways to corporate and outside services and public electronic mail
- Batch processing



WHAT USERS WANT IN TOMORROW'S PCs: MULTITASKING, WINDOWS AND MORE

On a scale of 1 to 5 (1=Very, 5=Not at all), how desirable would you deem the following product features for your longer-term future PC usage?"

(4, 062 Sites Surveyed, Q3 1991)

- Remote management
- Software licensing
- Bulletin board
- Facsimile transmission sending and receiving
- Customer billback
- Videotext

As organizations adapt to client/server architectures, some are dedicating servers to specific functions, such as database management or electronic mail, often so departmental servers' capacity can be used to handle file sharing tasks.

Seeing the Data With Forest & Trees

"Like most firms, we have multiple databases," says Paul Capalbo, manager of systems development at Heidelberg Harris USA—a $300M division of Heidelberg Druksmachinen, the world's largest manufacturer of printing presses and related equipment.

"Providing access to each database requires supporting a separate gateway, and the management of each gateway product can become a real nightmare," says Capalbo. "We really needed to find a way around it."

> *"The product easily reads to any of our databases, including flat files, Btrieve, Oracle, and Total. With* Forest & Trees, *providing access is simple, even over a network."*

The company has embarked on a distributed environment strategy to put data into the hands of end users via a common front-end client for applications accessing any database or other information source.

After evaluating several products, Heidelberg Harris purchased a 100-seat site license for *Forest & Trees* from Channel Computing, Inc.

"*Forest & Trees* addresses both our data access and front-end reporting needs," says Capalbo. "The product easily reads to any of our databases, including flat files, Btrieve, Oracle, and Total. With *Forest & Trees*, providing access is simple, even over a network."

"And the front-end reporting features allow us to easily customize user screens. It really is a quantum leap forward."

Heidelberg Harris has developed applications specifically designed to capitalize on *Forest & Trees'* data access and reporting capabilities.

One Heidelberg Harris program, 'Cop on the Block,' uses *Forest & Trees'* front-end capabilities to provide manufacturing managers with graphs that monitor individual workloads and order status throughout the manufacturing process. *Forest & Trees* accesses data from an Oracle database over a Novell network and must work in conjunction with an Omni5-based remote work assignment system.

'Financial Dashboard' accesses data from an IBM Platinum accounting system. Managers use a *Forest & Trees* front-end to review and analyze line item budgets. Icons created for financial indicators allow easy monitoring of the changing status of financial information.

Heidelberg Harris is so pleased with *Forest & Trees* that it is implementing it as the standard data access and reporting front-end on its 700-node, 32-server nationwide network.

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Channel Computing

From Data to Information

Channel Computing Inc. is a three-year-old, venture-funded company dedicated to making products that put data into and pull information from databases.

Channel's flagship product—*Forest & Trees*— is a widely praised data access and reporting tool that combines an easy-to-use, WYSIWYG, object-oriented report writer with access to data sources that extend from DB2, Oracle, Rdb, and SQL Server down to dBASE, 1-2-3 and Excel, with many others in between.

Forest & Trees goes beyond traditional report writers in important ways only recently made possible by emerging new computer platforms and technologies like graphical user interfaces, local area networks and client/server databases. Tabular views of data are presented on an easy-to-use graphical desktop and automatically updated at user-specified intervals, turning the computer display into an electronic dashboard of business vital signs. Data can be presented in a spectrum of formats and colors. Because reports are delivered electronically as well as on paper, users can point and click on an item of interest and drill down to the lowest level of detail. Reports become living, up-to-date instruments that turn data into information.

Achieving immediate recognition, Forest & Trees was named one of *Datamation's* Top 100 Products of 1990, awarded *Infoworld's* Buyer's Assurance Seal of Approval and was nominated for Best New Idea in their annual readers' choice awards.

Forest & Trees is available for Microsoft Windows 3.0, Hewlett-Packard NewWave 3.0 and Microsoft DOS. It supports most major LANs including Novell NetWare, Microsoft LAN Manager and Banyan Vines. An OS/2 PM Version 2 edition of *Forest & Trees* will be available later this year.

Channel Computing can be reached at 603/659-2832.

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TechGnosis, Inc.

Creating Middleware

SequeLink Client/Server MiddleWare™ is a comprehensive set of client- and server-resident software modules that provide direct access to host-based data and services from within client applications. *SequeLink* delivers all the economic and productivity benefits of client/server systems, incorporating your computing standards.

As a result of more than five years' experience in delivering client/server solutions worldwide, TechGnosis has developed the *SequeLink MiddleWare* architecture. Unlike any other client/server solution on the market, this modular system allows you complete freedom in choosing your client applications, networking protocols, client and server environments and database management systems.

With *SequeLink* you can offload current host-based applications (or develop new applications) to run on low-cost desktop systems, taking full advantage of advanced graphic workstation environments and compatible development and decision support tools.

While the application runs on the client, the data remains on the host, ensuring the integrity and security of your organization's most precious resource—its information. *SequeLink* makes that information an integral part of your client applications, increasing productivity, reducing the time and effort needed to develop new applications, decreasing the workload on expensive host systems and lowering the cost of running your applications.

SequeLink is currently available for the following environments:

- Applications: Excel, Wingz, HyperCard, ToolBook, 4th Dimension, SmallTalk, Visual Basic, Power Builder, Lotus 1-2-3, Easel. A complete Application Programming Interface (API) is available on all platforms.
- Client environments: Macintosh, Microsoft Windows, Presentation Manager (OS/2), Sun SPARC, RS/6000, SCO UNIX, DEC Risc, HP/9000.
- Network protocols: TCP/IP, DECnet, NetBIOS, NetWare, APPC, AppleTalk.
- Server Environments: OS/2, Sun SPARC, RS/6000, Macintosh A/UX, AS/400, VAX, DEC Risc, SCO UNIX, HP/9000, MVS.
- DBMS engines: Oracle, Ingres, Sybase, Rdb, SQL Server, Informix, System 1032, AS/400 Relational Database, OS/2 EE Database Manager, DB2.

Site licensing is available. For more information, contact TechGnosis toll-free at 800/321-0543.

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strategic advantage, more than a few client/server system implementers refuse to discuss the specifics of their applications.

"Client/server applications are taking computing beyond task automation," comments Channel Computing's Sullivan. "Data is being made more accessible to the user. Client/server applications pull data off an old transaction system and put it on the network where users can analyze it, manipulate it, share it."

A New Age

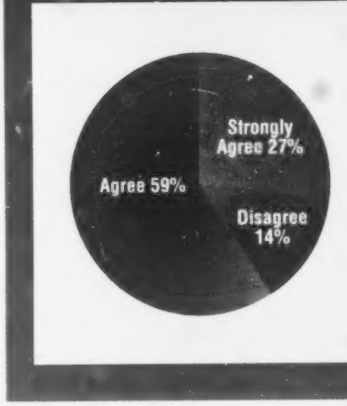
The issues of client/server system deployment—the plans and the goals, the problems and the solutions of those accomplishing client/server computing—are not simple. Viewed separately, these matters can seem to be little more than the ephemeral fashions of high tech wizardry, glittering briefly before they disperse into the ebb and flow of larger, steadier currents.

But occasionally come moments of sea change. Client/server computing signals one such moment when apparently disparate trends, inclinations and technical possibilities coalesce into a new information systems age in which:

- *Organizations*—utilizing complex networks of hardware, software and services from multiple vendors—are able to provide productive team computing environments for groups of

"OBJECT ORIENTED PROGRAMMING WILL PLAY AN INCREASINGLY IMPORTANT ROLE IN OUR INTERNALLY DEVELOPED C/S APPLICATIONS."

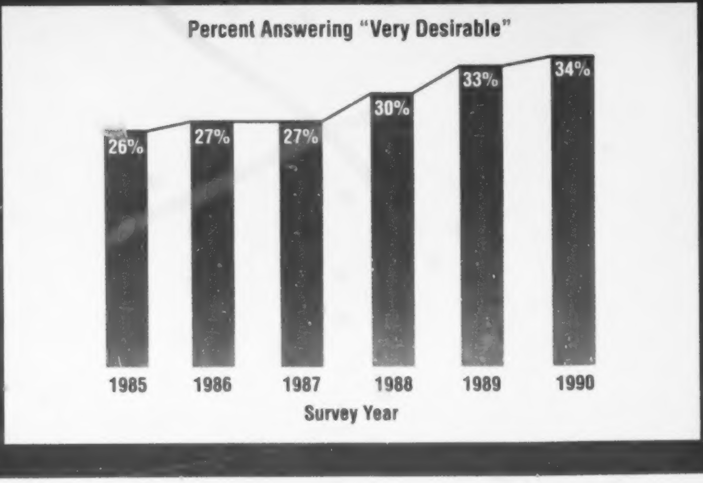
Responses of 100 Fortune 1000 MIS and End User Executives who are early adopters of Client/Server Computing.



BUILDING INTEREST IN UNIX-LIKE CAPABILITIES FOR PCs

"How desirable would a multi-user operating system (e.g., UNIX) capability be to you for your PCs?"

(4. 062 Sites Surveyed, Q3 1991)



workers long isolated from each other. Because work is created and communicated with information systems, the knowledge of employees not only will be shared but preserved, ultimately expanding the knowledge base of the entire enterprise.

- *IS* benefits from vendors' compliance with a wide range of product standards that results in interchangeable, open systems. So applications are ported from machine to machine and system to system without difficulty and system configurations are scaled to meet the expansion, contraction and realignment of the organization's various elements without disrupting operations. Meanwhile, system management tools assure data integrity and handle day-to-day network and data management. Application development environments help reduce and even eliminate application development backlog through programming techniques emphasizing code re-use and, eventually, end user programming of simpler routines.
- *End users* hardly ever think about computers, even when they're programming them. That's because end users enjoy unparalleled ease of use and transparent access to both corporate and public information; the software tools they utilize to manipulate information are flexible and exploit natural language, straightforward images and expert systems. The machines on end users' desks, as well as the machines in their briefcases, allow them to undertake several tasks at once and engage an assortment of integrated media—including data, text, graphics, scanned image, sound and full-motion video—in the pursuit of greater efficiency, better ideas and new products and services.

Getting From Here to There

"In the 21st century," says Bill Joy, vice president of research and development at Sun Microsystems, "it will no longer be sufficient to put computers into environments. They must be part of the environment."

Exotic as it sounds, the rich potential of this new information systems age is already being actualized. Take note:

The Architectural Imperative

If the promise of client/server systems are to be realized, then it will be in the form of a new kind of computing architecture. This client/server architecture is incorporating several principles and capabilities, including:

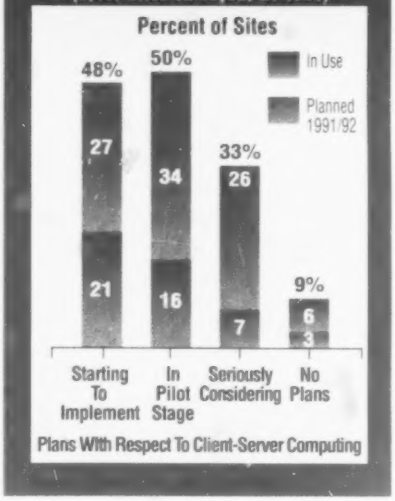
- *Multitasking.* Over 90% of BRG survey respondents thought it important that servers be able to perform multiple functions simultaneously. Depending on the organization and the application, some client/server system builders may also need to deploy multitasking clients.
- *Multiple operating system integration.* It is not unusual for a single client/server system to be running several different operating systems at once. DOS, OS/2 and UNIX operating systems commonly appear on both clients and servers, and, as research by Cowen & Co. indicates, interest in UNIX-like capabilities for PCs has been building for several years as organizations develop multi-user, multitasking client/server systems of greater and greater power.
- *Portability.* Because client/servers systems encompass an assortment of hardware platforms, and because they often must be compatible with the implementer's existing information systems, it is vital that the application software used in a client/server system can be ported to different hardware platforms from multiple vendors.

CLIENT/SERVER IMPLEMENTERS TURN TO CLIENT/SERVER DBMS

"Are you using or planning to use a client-server DBMS for your PC network?"

Where does your organization stand with respect to client-server computing?"

(2,487 Sites Surveyed, Q1 1991)



- *Scalability.* Even more critical to many organizations implementing client/server computing is the assurance that their hardware can be upgraded without affecting software performance. This allows uninterrupted system growth and gives organizations the ability to tailor their systems to changing times and needs. It makes eminent sense, therefore, that BRG found scalability to be a key client/server purchase criteria for the vast majority of the Fortune 1000 executives it surveyed.
- *Application development productivity.* As client/server systems take their place alongside mainframe and minicomputer installations, often interacting with these older systems and relieving them of many end user computing burdens, IS departments are finding that PC/LAN-based application development can be faster and therefore more

productive than application development for traditional mainframe and minicomputer environments.

"With client/server computing, organizations have the latest graphic, workstation-based decision support and application development tools available to build systems that until now had to reside where the data resided," TechGnosis' Toleman declares.

Among the challenges facing application developers is the need to build client/server applications that are compatible with existing mainframe systems. Sterling Software's *Corporate Applications Management Initiative (CAMI)* offers a complete life cycle

Synchrony Updates Travelers Fast

"It was taking several weeks for updates to be reflected in field office contracts and that just wasn't acceptable," recalls Barry Edmonds, systems director at The Travelers Insurance Company, Hartford, CT.

Several years ago, The Travelers' information systems group designed a client/server-based 'contracts analysts workstation' to automate the production of its benefits booklets.

A critical component of the application is the generic-text paragraphs generated by the legal department for incorporation into the booklets. The paragraphs are regularly updated and, for liability reasons, it is imperative that the contract analysts work with the most recent updates.

"We tried to use the corporate e-mail system to distribute the updates, but it didn't work very well. Users had to log on to the system correctly and even if that was done we still had no way to verify that the files were properly installed."

> *"It frees up a lot of memory on the workstations."*

The question was: how to synchronize the updates to the application? For the answer, The Travelers turned to the *Synchrony* software distribution management system from Telepartner International, Farmington, CT.

Initially, The Travelers used *Synchrony* for overnight automatic transmission and installation of up to 140 file updates on 138 contract analyst workstations.

"Today we use *Synchrony's* file server update," says Edmonds. "With access to the server, we only have to send the contract updates to our five servers. It frees up a lot of memory on the workstations."

Synchrony's distribution list system made the switch simple.

"The systems administrator just lists the names of the locations. It doesn't matter whether you designate one or 150 locations or whether those locations are client or server. Everything is verified and it's fast."

In addition to file maintenance, Edmonds' group has put *Synchrony* to work delivering software program changes and answering maintenance requests.

"We are actually delivering updates of the contract analyst workstation system software using *Synchrony.* I wouldn't have even tried that before," he says. "I don't think another product could do what *Synchrony* has done for us."

Telepartner International

Managing Distributed Applications

The demanding requirements of workgroup and enterprise applications has helped drive the development of more powerful machines and the definition of a new application architecture, client/server computing. These technical advances, in turn, made possible the implementation of increasingly sophisticated distributed applications that improve the way companies sell, serve customers, manage inventories, control costs and make decisions.

A key requirement for mission-critical client/server systems is effective application management. Managing application deployment and maintenance to ensure availability and integrity, while controlling associated costs, becomes a real challenge. Now there is software designed and built from the outset for flexible, reliable, highly integrated distributed application management: *Synchrony.*

***Synchrony* automates the entire process of managing the deployment and maintenance of distributed applications. It delivers and installs software. It rolls back software changes. It distributes data and text. It collects data for backup or consolidated reporting. *Synchrony* does all of this interactively, or on a scheduled, unattended basis with almost no involvement from the end user. For unattended updates, the user simply makes a menu selection from *Synchrony's* Workstation client. *Synchrony* does the rest automatically.**

***Synchrony's* Administrator client provides a complete set of integrated tools for assembling components of a distribution and packaging them for delivery and installation; creating and maintaining distribution lists; and scheduling and monitoring the status of distributions and retrievals. *Synchrony's* server, the Communications Manager, installs thousands of updates overnight with a high level of performance and reliability for direct, dial-up or LAN connections using existing networks and staff.**

***Synchrony's* field-proven technology is used in demanding distributed computing environments to keep applications up to date and 'in sync.' Available today, *Synchrony* is the choice of companies for managing the distributed applications that are driving their business success in the 1990s.**

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development environment that produces applications consistent with IBM's AD/Cycle and SAA strategies embracing both IBM and non-IBM platforms.

Some newer programming techniques—particularly object-oriented programming, which enables the development of reusable code and the creation of reusable code libraries—will make new application development more productive still. Although many organizations are concerned about the need to retrain IS staff to deal with the demands of client/server computing, even more of those BRG interviewed plan a growing role for object-oriented programming in their internally developed client/server applications.

"Current object-oriented products require new ways of thinking, different programming techniques, and that will take time to achieve," says Dennis McEvoy, president and CEO of Cooperative Solutions. "But users would love to have the benefits of object-oriented programming like re-usable application components."

Easel Corp.'s vice president of marketing, Steve Sayre, agrees. "Object-oriented programming is important to client/server computing," he says. "It's compelling to IS because maintenance is such a burden and new application development is pursued in most organizations by only a few people."

And eventually end users themselves will become involved in application development.

"As client/server computing evolves," says Sayre, "we'll see more applications being developed at the department and even the desktop level, so applications will be increasingly business- and enterprise-oriented."

The Inevitability of Open Systems

There is no inherent interdependence between client/server computing and open systems, but since many organizations require that new client/server systems be compatible and interoperable with existing applications and hardware so investments in present systems, applications and trained personnel are not squandered, open standards-based client/server system configurations have obvious appeal.

"The theory behind openness is that all technology can benefit from improvement and that all customers benefit from such innovation," notes Scott McNealy, president and CEO of Sun Microsystems. "The fundamental premise in defining openness is a positive answer to a simple question: Can this technology benefit from innovation, from being faster, more full-function and cheaper?"

It is not surprising that more than half of those surveyed by BRG last year cited compliance with open system standards as an essential client/server purchase criterion.

"Customers want to be able to mix and match IS products, utilizing their resources the way they see fit to get the job done," says Ken Dixon, vice president and head of the Synchrony business group at Telepartner International.

Client/Server DBMS: A Key to the Kingdom

One of the cornerstone standards in client/server computing is relational database management software with Structured Query Language (SQL), which assures data

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environments—for instance, adding or deleting data from one set of tables will not contaminate data residing elsewhere on the server—and thus enables development of mission-critical client/ server applications.

Using SQL as a *de facto* standard, vendors are re-designing their DBMS products to perform in client/server environments; usually, the DBMS and data reside in a server, while application logic and control are located in the clients. Crucial to a client/server DBMS' effectiveness is its ease of use and its ability to share processes and data and exchange information on the network.

Today's client/server DBMS products often support relational functionality and database semantics and are increasingly object-oriented. Some enable an application to connect to multiple database servers, thus providing end users with access to a broad range of information.

For example, Sterling Software's *Answer* products—including *Answer/Server, Answer/SQL, Presentation/Answer* and *Micro/Answer II*—allow end users to access and download mainframe files to PCs and workstations from multiple vendors. *Answer* products can be used with numerous DBMS offerings and do not require that end users know where or how data is stored.

It is understandable, then, that 80% of the Fortune 1000 IS and end user executives BRG talked to said they are or will be developing applications in-house using a client/server database. And Cowen & Co. research shows that the more involved in client/server computing an organization is, the more likely it is to be using or planning to use a client/server DBMS.

"The DBMS is one of the building block components of the client/server environment, and it will become even more important in the future," maintains Fred Braddock, vice president of research and development at Sterling Software. "Issues of data integrity and security come into play at the level of data extraction and data update, so system security and data integrity matters reside with the DBMS."

Hence those putting client/server DBMSs to work seek products with some necessary data integrity features, including:

- Full database administration and security utilities,
- Stable transaction throughput via space management techniques and specialized input/output handling,
- Data access optimization,
- Automatic locking of records and rollback of partially completed transactions, and
- Recovery of completed transactions in case of system failure.

"IS is held to a much higher standard of performance than any other group in an organization," says John LePere, director of product planning at Global Software. "So IS needs to be sensitive to how data is used and IS wants tools that protect the information assets of the company."

Graphical User Interfaces and Beyond

Graphical user interfaces (GUIs)—those operating environments that act as an interface between the end user, applications and the underlying operating system—are what makes a computer easy to use. Because the same GUI can act as a client front-end for all applications on a client/server system, end users deal with the same screens, menus and methods as they learn and use all software applications, thus reducing training

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Cooperative Solutions

Client/Server Transaction Processing

Cooperative Solutions' *ellipse* is the first software product designed specifically for developing, deploying and managing on-line transaction processing (OLTP) applications that take full advantage of client/server platforms.

ellipse enables client/server transaction processing (CSTP) applications to combine the reliability of mainframe environments with the flexibility, price/performance and ease-of-use of PC/LAN client/server architectures.

The ellipse Production System (ellipse/PS) enables applications to meet the stringent requirements for traditional

OLTP applications as well as the new requirements for CSTP applications. As the first client/server management system, *ellipse/PS* is responsible for robust, predictable, consistent transaction processing. It automatically provides application and data integrity, systems availability, distributed transaction management, recovery from errors, performance optimization and application partitioning between the client and server. No further programming is required.

ellipse/PS is designed to operate in a variety of client/server environments. Customers' applications are independent of the particular DBMS, presentation service, communication and even operating system. It ensures portability of all *ellipse*-based applications with no additional programming.

Producing robust, reliable and easy-to-use applications have been difficult (most say impossible) without experienced systems-level programmers. The Ellipse Development Environment (*ellipse/DE*) changes this.

Project teams use *ellipse/DE* to develop, test and maintain CSTP applications. *ellipse/DE* is designed to leverage the experience of programmers who need not learn the C language or new concepts such as application partitioning, event-loop programming or distributed transaction management.

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time and expense, boosting productivity and heightening job satisfaction.

For GUIs to fulfill their promise, users and vendors must choose one or a few standard GUIs so that software products can be designed to work with them. These choices are being made in the marketplace now as major operating systems and GUIs are paired: the Windows GUI will serve the DOS software community, OS/2 products will be designed for Presentation Manager, UNIX systems will opt for OPEN LOOK or OSF/Motif. Terminals, meanwhile, will use the X-Windows GUI.

So, although just 31% of the 100 early adopters of client/server computing BRG surveyed have included a GUI with their client/server applications, as the decisions of the marketplace take root, more and more client/server computing implementers will deploy GUIs on their systems.

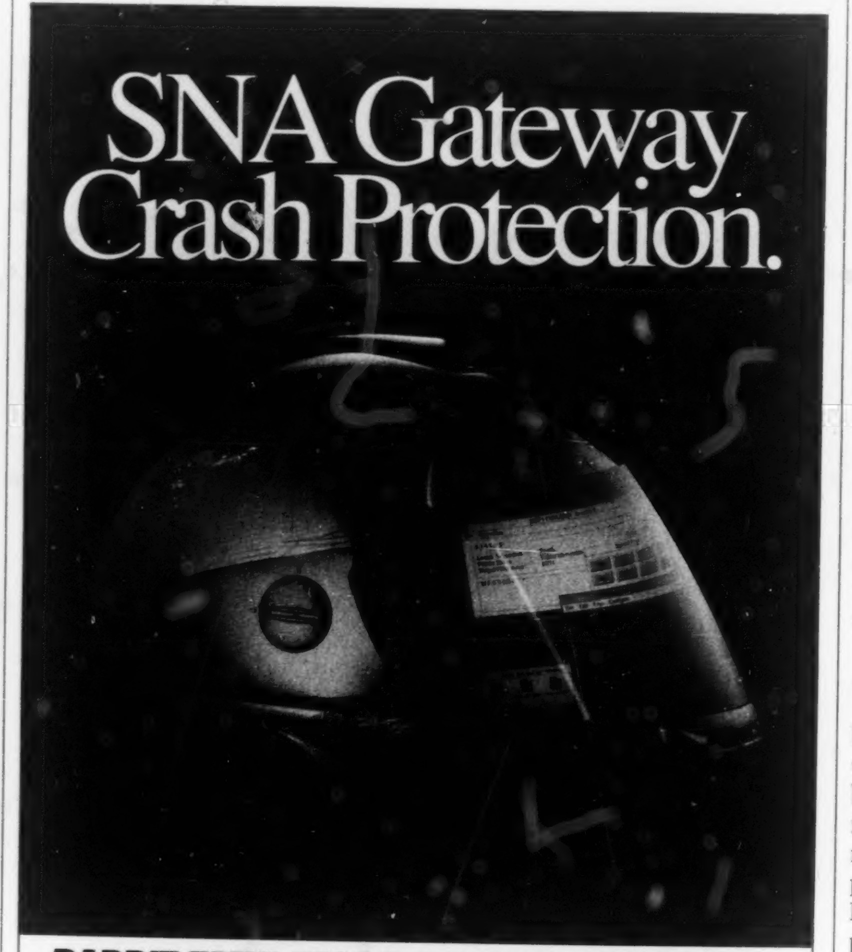
Already GUI-oriented development tools are available to make such efforts easier. Easel Corp.'s OS/2-based *Easel Workbench*, for instance, integrates a suite of visual programming tools, code-generation capabilities and an incremental compiler to help developers turn out graphical applications.

The next step involves integrating text, graphics and images—the beginnings of true multimedia capability that will ultimately include sound and full-motion video, too. For those building client/server systems, this is not as blue-sky as it appears: over 75% of the Fortune 1000 IS and end user executives queried by BRG thought text/graphics/image integration was an important aspect of their client/server strategies.

Applications New and Used

BRG reports that for some builders of client/server systems, a lack of interoperability between client and server is inhibiting application development. This may account in part for why 58% of those BRG interviewed are rewriting previously existing applications rather than creating new ones for their client/server deployments.

"The greatest challenge facing those implementing client/server computing is the state of the data," asserts Sullivan of Channel Computing. "The vast majority of data is not understandable, since everything is stored in code. If a company has not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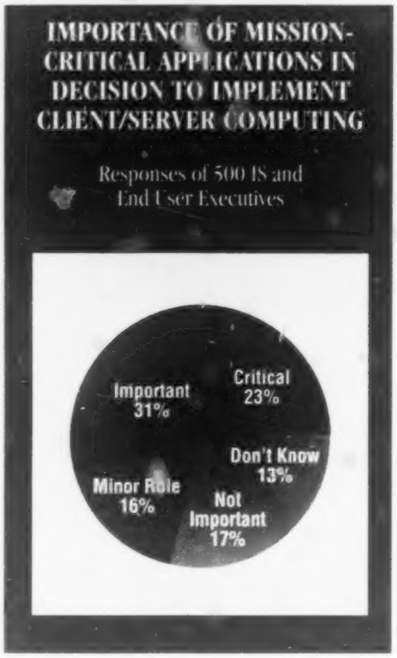

IMPORTANCE OF MISSION-CRITICAL APPLICATIONS IN DECISION TO IMPLEMENT CLIENT/SERVER COMPUTING

Responses of 500 IS and End User Executives

thought through its data structure, if the data is meaningless in relation to business problems and solutions, then front-end tools become meaningless."

Although user organizations must conduct their individual struggles with data structure, software products developed especially for client/server application environments address interoperability problems. As these client/server front-ends come to market, those developing and using client/server systems will no longer struggle with interoperability problems and will be able to exploit client/ server computing's full potential for improving organizational productivity.

Among the many new kinds of software emerging for use on client/server systems are:

- Application data access and monitoring tools. Workgroups linked by client/server systems can be more productive if their managers can collect, combine and automatically track information from the applications, database files and database servers used. Channel Computing's SQL-based *Forest & Trees*, for instance, gathers and summarizes information from a wide range of PC/LAN sources, including spreadsheets, database files and database servers, presenting information in user-defined 'views.'
- "Middleware" tools. Since client/server implementations often incorporate several vendors' disparate software and hardware products, some of it not designed for a client/server configuration, "middleware" is sometimes needed to enable applications to work independently of data, location and system structure. *SequeLink*, a workstation/host DBMS connectivity tool from TechGnosis, can shield users from network and DBMS variables, and *SequeLink Engine* allows access to nonrelational host-based data and services.
- Software and data management tools. As applications are implemented on client/server systems, software and data must be distributed and maintained in ways that are cost-effective and ensure data integrity and availability. *Synchrony* from Telepartners International, for example, delivers, installs and retrieves PC/LAN program and data files; *Synchrony* will run unattended, scheduling and monitoring the status of distributions and retrievals.
- Client/server application development tools and languages. Although some discover that their client/server configurations can be nearly as expensive to operate as mainframe systems, new client/server development environments are a source of client/server cost benefits because they enable client/server application development in less time than a comparable mainframe application.

Ellipse from San Jose, CA-based Cooperative Solutions, for instance, enables the development of client/server-oriented on-line transaction processing applications for DOS and OS/2 environments; *Ellipse* works with existing data and applications and functions independently of operating system, communication method, DBMS, GUI and transaction manager. A UNIX version of *Ellipse* for Sun Microsystem platforms will be available early in 1992.

Some providers of mainframe software understand the need for interoperability with client/server systems and are responding with the necessary bridges. One such software vendor is Global Software, which sells business application software for IBM mainframes. Global's *Harmonix* cooperative processing products for accounting applications moves the processing and interface parts of the application to the PC while the mainframe continues to oversee data integrity and security.

Support from the Vendors

In an open systems world in which client/server computing is becoming increasingly prominent as a way for organizations to stay productive and competitive, the quality of a vendor's products and customer support will be a primary way it is differentiated from others. This will, of course, serve to improve support, for those vendors lacking it will lose their customers to those who provide it.

"Customer service, in terms of technical support and general training, will increase in importance to users during the 1990s," believes Warren Blossom, vice president of marketing at Motorola's Commercial Systems Division. "This will be especially true as users build multivendor networks, because they have the freedom to choose vendors that not only offer the most suitable product for their applications, but the most attractive service as well."

Mission: Critical

Users are looking for three things from client/server computing," says McEvoy of Cooperative Solutions. "First, they want aggressive price/performance. They know that price/performance of PCs, workstations and servers is increasing by 50% a year."

"Next, they want the ability to deploy more functionality. They're learning the client/server architectures require less training for end users while providing increased access to more data. And, lastly, users want help reducing application development time."

As these end user and IS interests, needs and concerns are met by client/server computing, organizations will increasingly turn to client/server systems for enterprisewide, mission-critical applications.

Indeed, mission-critical client/server computing is already happening: BRG has found that 44% of the Fortune 1000 IS and end user executives it surveyed have built or are planning client/server systems that run mission-critical applications; of these, 44% are new applications, 38% are re-implemented and 18% are planned but not yet launched.

Many of those implementing mission-critical client/server systems are planning not application-by-application, but for the entire enterprise.

Still, much of today's enterprisewide computing—client/server-based or otherwise—is strategy rather than implementation. But in notable ways, that does not make it any less real. For those implementers and planners who choose to ponder how to accomplish enterprisewide computing are actually engaged in a vital process: they are rethinking the enterprise itself—how it will compete and succeed in the global economy of the 21st century.

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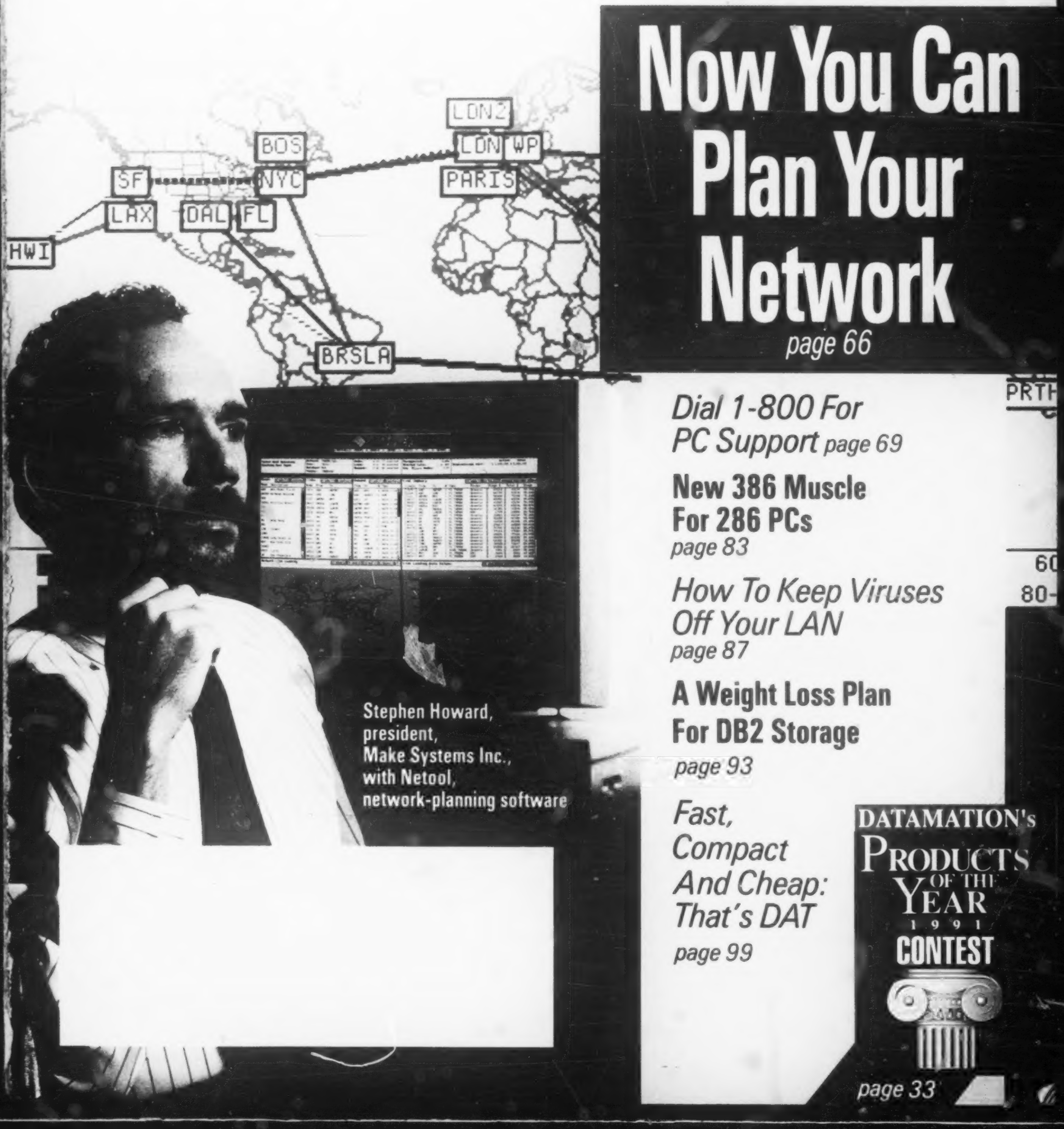

Stephen Howard, president, Make Systems Inc., with Netool, network-planning software

Now You Can Plan Your Network

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New 386 Muscle For 286 PCs
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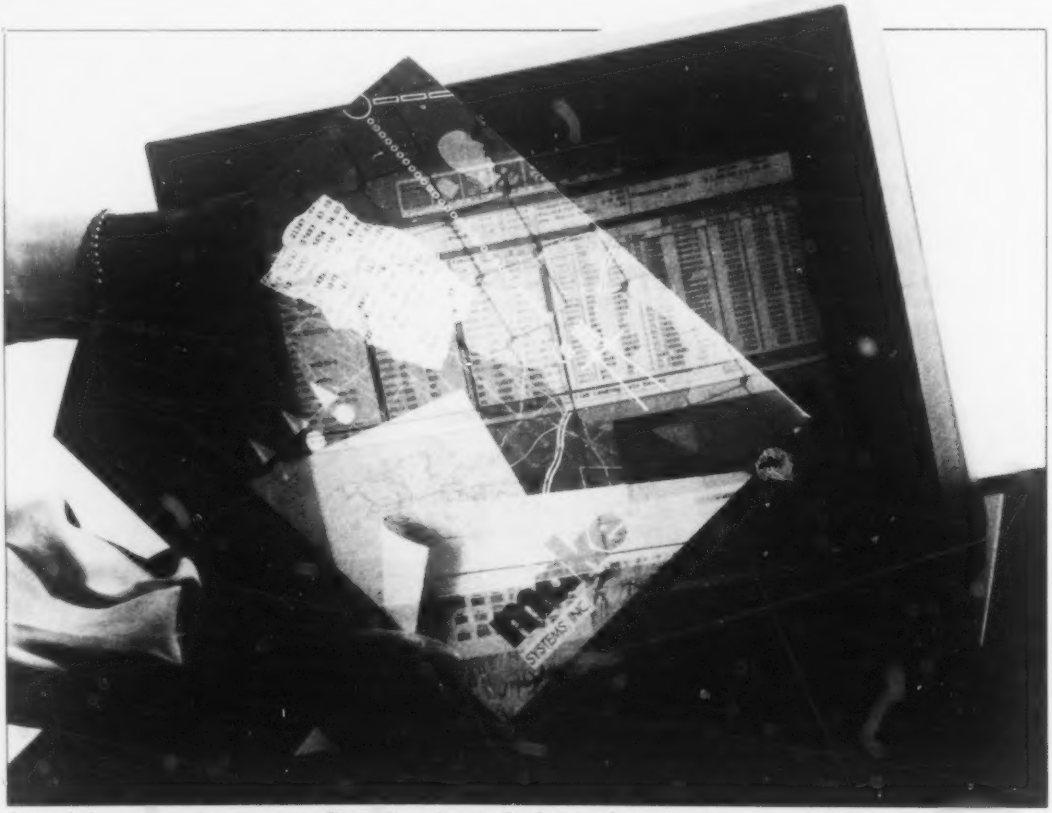

Netool gives network managers a firm grip on increasingly complex networks.

COVER STORY

NETWORK MANAGEMENT

Now You Can Plan Your Network 66

BY TOM McCUSKER California start-up Make Systems is getting high marks for its Netool network-planning software, which allows users to design, operate and optimize large networks with nearly 100% accuracy.

Cover photography by Chris Springmann

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SPECIAL REPORT

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Products Of The Year 33

BY ELIZABETH LINDHOLM Here's your chance to tell the world which of this year's crop of computer products are the best. Cast your vote in DATAMATION's second annual Products Of The Year Contest.

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BY LAMONT WOOD PC suppliers are falling all over themselves to see who can offer the best toll-free telephone support. But should end users call when their PCs fail?

Computer's on the fritz. Who ya gonna call?

INTERVIEW

Microsoft Talks MIS 74

BY DAVID R. BROUSELL In an interview with DATAMATION, Microsoft president Mike Hallman gives his views on the challenges facing MIS and the role the world's largest software company wants to play in meeting them. But how far will Microsoft go?

PCs & WORKSTATIONS

PC/AT UPGRADES

New 386 Muscle For 286 PCs 83

BY STEVE PAUL Move aside, PC/AT. A stream of add-on products is available to keep the venerable 286 PC afloat with 386 power.

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How To Keep Viruses Off Your LAN 87

BY MARK SCHLACK The viral threat is real, but you can minimize the danger to your networks with the right software and operating practices. Better safe than sorry.

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BY MIKE RICCIUTI Seems DB2 just keeps on eating DASD—and asking for more. These new tools can curb DB2's appetite and trim your storage costs, too.

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Fast, Compact And Cheap: That's DAT 99

BY DWIGHT B. DAVIS Are your operators' feet wearing out from trotting back and forth changing low-capacity, nine-track tapes during nightly backups? Inexpensive digital audio tape technology could solve your problem.

Microsoft's Hallman looks at the PC as a window on "this information stuff," page 74.

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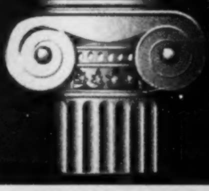

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MARKET INSIGHTS

AN ANALYSIS OF ECONOMIC TRENDS

A Healthy Future For Medical IT

BY MADELINE FRANCHI
Cahners Economics

Wisdom may come with age, but so does increased spending for health care services. Inflation-adjusted consumer spending on medical care in the United States rose from an annualized $299.3 billion in the second quarter of 1990 to $314.4 billion during the same period of 1991, a 5.1% increase. And as the baby boom population enters its graying years, spending patterns are shifting away from Porsches and Polo shirts to lab tests, diagnostic services, pharmaceuticals, X rays and eye care services.

This growing demand for health services is and will continue to create an influx of new health workers. In June 1991, this sector employed just over 8.2 million people, a rise of 4.8% from a year earlier. Increased demand will also generate an even more rapid adoption of computer systems and networks to serve the increasingly complex needs of medical professionals.

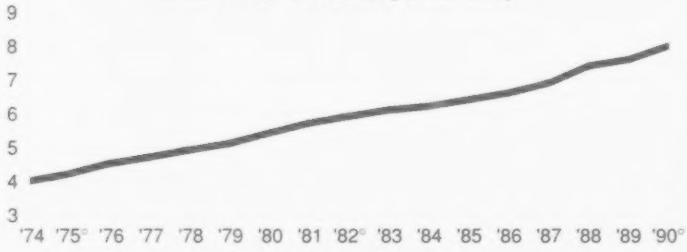
According to Market Intelligence Research Corp. of Mountain View, Calif., the major medical technological trend of the 1990s will be the integration of clinical data into relational databases that are accessible to physicians and other medical professionals. Data needed include medication history from the pharmacy, X-ray results from radiology and test results from the laboratories.

This strengthening demand for improvement in medical information technology will push more and more hospitals to replace their existing information systems with larger and more complex software and hardware. As a result, Market Intelligence predicts, revenue from the medical IS market will grow 24% between 1990 and 1994 to reach $2.2 billion and will top $2.8 billion in 1997, another 24% rise. ▭

For more information on Cahners Economics's forecasting services, including seminars, newsletters and database diskettes, call Dan Buchan at (617)-630-2105, send him a fax at (617)-630-2100 or write to him at Cahners Economics, 275 Washington Street, Newton, MA 02158.

No Doctor Needed For Medical IT

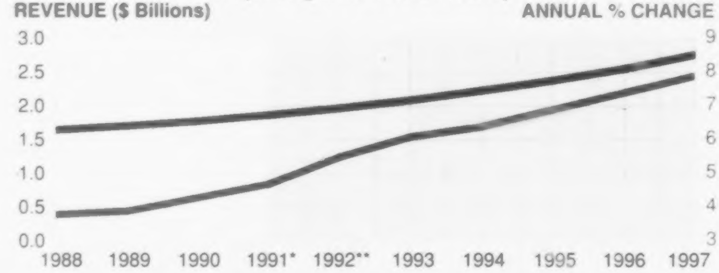
Employment in health services defies recessions.



° Recession Year

Source: U.S. Commerce Department, Bureau Of Labor Statistics

IT spending in the medical industry



* Estimate
** Forecast Begins

Source: Market Intelligence Research

The Economy At A Glance

	Actual			Forecast	
	Q1/91	Q2/91	1991	1992	1993
Gross National Product	-2.8	0.4	-0.1	3.0	2.5
Business Investment In Equipment	-18.4	-1.6	-3.5	4.8	4.2
Government Spending	-1.3	2.1	1.2	0.0	0.5
Consumer Spending	-1.5	3.6	0.4	2.2	2.2
Exports	0.5	3.7	4.2	5.1	4.3
Imports	-8.8	21.2	0.7	4.1	2.3

All calculations are % change in 1982 dollars; quarterly figures are seasonally adjusted annual rates

	June 1991	May 1991	% Change 6/91-5/91	June 1990	% Change 1991-1990
Manufacturing Production (1)					
Process Industries Total	105.3	104.0	1.2	108.9	-3.3
Chemicals	109.6	109.2	0.4	110.3	-0.6
Petroleum	109.0	107.4	1.5	106.5	2.3
OEM Total	109.9	109.2	0.7	115.1	-4.5
Computers & Peripherals	151.6	154.2	-1.7	150.6	0.7
Communication Equipment	112.8	113.0	-0.2	110.8	1.8
Transportation Equipment	99.4	98.1	1.3	111.0	-10.5
Services Employment (2)					
Finance, Insurance, Real Estate	6.770	6.707	0.9	6.817	-0.7
Health Care	8.245	8.156	1.1	7.866	4.8
Computer & Data Processing	0.835	0.826	1.1	0.783	6.6
Transportation/Utilities	5.853	5.816	0.6	5.869	-0.3
Retail Trade	19.476	19.314	0.8	19.878	-2.0
Wholesale Trade	6.111	6.084	0.4	6.262	-2.4
Government	18.516	18.813	-1.6	18.651	-0.7

(1) Index 1978=100, seasonally adjusted
(2) Millions of persons, not seasonally adjusted

Source: Commerce Dept. and Cahners Economics

MARKET INSIGHTS

A SURVEY OF TECHNOLOGY TRENDS

LAN Management Is Serious Business

BY WARREN CHILDS
Business Research Group

Desktop computing and local area networking are rising rapidly in importance among corporate users. And they are taking LAN administrators right along with them. How the LAN is managed has become critical to the success of a business. As a result, companies are increasingly bringing LAN administration responsibilities into the IS shop and are committing additional resources to improving LAN managers' technical skills.

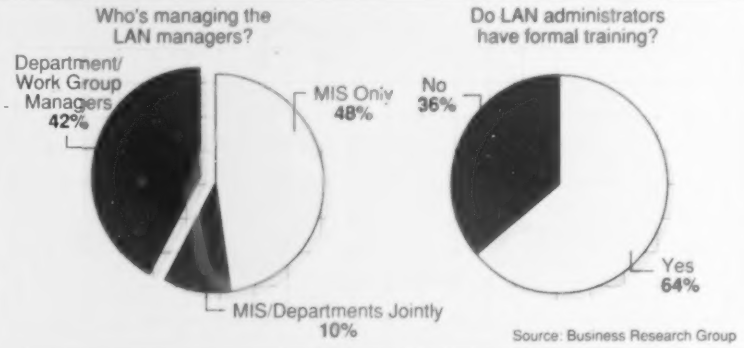
That contrasts with LAN administration in the recent past, when management of the LAN was a departmental responsibility. Departments selected, trained and managed their LAN administrators or, just as often, delegated the responsibility to a power user or collectively attempted to solve problems when they arose.

Indications of the changes under way in LAN administration come from a recent survey by the Business Research Group of 400 *Fortune* 1,000 companies. The survey shows that at 48% of sites, LAN administrators now report directly to MIS departments, and at 10% of the sites MIS managers share responsibility for LAN administrators with department or work group heads. However, MIS still is not in charge of LAN management at 42% of the companies surveyed; at these, LAN administrators still report to either department or work group heads.

Whether managed by MIS or department heads, LAN administrators still must possess both the technical knowledge necessary to carry out network administration and the ability to train users in the applications running on the network. BRG's survey reveals that in 64% of companies these requirements have led to formalized training programs for LAN administrators. MIS will take on a larger role in overseeing LAN administration and maintenance as a result.

For more information, call Nancy Finn at (617)-964-6204, send her a fax at (617)-558-4402 or write to her at the Business Research Group, 275 Washington Street, Newton, MA 02158.

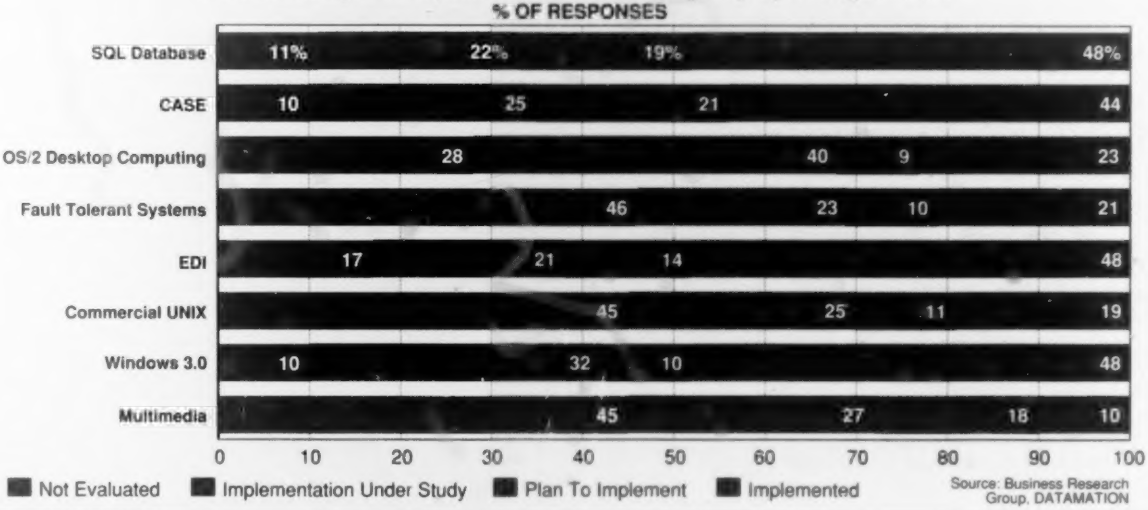
MIS Takes Charge Of LAN Administration



Source: Business Research Group

DATAMATION's Technology Implementation Index: Systems And Software

DATAMATION each month surveys a select group of its readers–the DATAMATION Technology Panel–to investigate the implementation of new technologies by key user organizations.



Source: Business Research Group, DATAMATION

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